DECLARATION

I, Sakiko Kobori, of 14-2-306, Yayoi-dai, Izumi-ku, Yokohama-shi, Kanagawa-ken 245-0008, Japan, do hereby declare that I am familiar with the Japanese and English languages, that the attached translation of Japanese Patent Application number 2002-288166 has been prepared by me and that it is a true translation to the best of my knowledge and ability.

On this 1st day of September

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[Title of Invention] CONNECTOR ANTI-ROTATION DEVICE AND CONNECTOR ANTI-ROTATION STRUCTURE

[Scope of Claims]

[Claim 1] A connector anti-rotation device to restrain relative rotational movement of a pipe including an inserting side portion of straight tubular shape and a connector having a connector housing provided with a connecting portion for a mating member to be connected to the pipe on one axial end of the connector housing, the inserting side portion of the pipe being inserted in the connector housing through an opening of the other axial end thereof and connected thereto, comprising;

a pipe connecting portion to be connected to the inserting side portion of the pipe in anti-rotating relation, and

a connector connecting portion to be connected to the connector in anti-rotating relation, the connector connecting portion being constructed on the pipe connecting portion.

[Claim 2] The connector anti-rotation device as set forth in claim 1 wherein the pipe connecting portion is connected to the inserting side portion of the pipe while tightening the inserting side portion in anti-rotating relation.

[Claim 3] The connector anti-rotation device as set forth in claim 2 wherein the pipe connecting portion is formed in C-shape or C-shape in cross-section and is to be pressed against an inner surface of the other axial end portion of the connector housing so as to be narrowed in diameter on insertion through the opening of the other axial end in the other axial end portion of the connector housing, and thereby to be connected to the inserting side portion while tightening the inserting side portion of the pipe in anti-rotating relation.

[Claim 4] The connector anti-rotation device as set forth in claim 2 or 3, wherein an elastic material layer is formed between the pipe connecting portion and the inserting side portion of the pipe.

[Claim 5] The connector anti-rotation device as set forth in claim 2 wherein the pipe connecting portion includes a spring member of C-shape or C-shape in cross section, to be mounted to the inserting side portion of the pipe while tightening the inserting side portion non-rotatably and a spring engageable portion to be engaged with the spring member non-rotatably.

[Claim 6] A connector anti-rotation device to restrain relative rotational movement of a pipe including an inserting side portion of straight tubular shape and a connector having a connector housing provided with a connecting portion for a mating member to be connected to the pipe on one axial end of the connector housing and a retainer holding portion holding a retainer on the other axial end of the connector housing, the inserting side portion of straight tubular shape being inserted in the connector housing through an opening of the other axial end thereof and connected thereto, the inserting side portion of the pipe being connected to the connector housing by engagement with the retainer, the retainer being held by the retainer holding portion via engagement with an engagement window formed on the retainer holding portion, the device comprising;

a pipe connecting portion to be connected to the inserting side portion of the pipe in anti-rotating relation, and a connector connecting portion constructed on the pipe connecting portion to be connected to the connector in anti-rotating relation, wherein,

the connector connecting portion is connected to the connector in anti-rotating relation by engagement non-rotatably with the engagement window of the retainer holding portion.

[Claim 7] A connector anti-rotation device to restrain relative rotational movement of a pipe including an inserting side portion of straight tubular shape and a connector having a connector housing provided with a connecting portion for a mating member to be connected to a pipe on one axial end of the connector housing and a retainer holding portion holding a retainer on the other axial end of the connector housing, the inserting side portion of the pipe being inserted in the connector housing through an opening of the other axial end thereof and connected thereto, the inserting side portion of the pipe being connected to the connector housing by

engagement with the retainer, the retainer being held by the retainer holding portion in anti-rotating relation, the device, comprising;

a pipe connecting portion to be connected to the inserting side portion of the pipe in anti-rotating relation, and a connector connecting portion constructed on the pipe connecting portion to be connected to the connector in anti-rotating relation, wherein,

the connector connecting portion is connected to the connector in anti-rotating relation by engagement non-rotatably with the retainer.

[Claim 8] A connector anti-rotation structure to restrain relative rotational movement of a pipe including an inserting side portion of straight tubular shape and a connector having a connector housing provided with a connecting portion for a mating member to be connected to the pipe on one axial end thereof, the inserting side portion of the pipe being inserted in the connector housing through an opening of the other axial end thereof and connected thereto, the connector anti-rotation structure comprising;

the connector anti-rotation device having a pipe connecting portion connected to the inserting side portion of the pipe in anti-rotating relation, and a connector connecting portion constructed on the pipe connecting portion and connected to the connector housing in anti-rotating relation, the connector connecting portion being connected to the connector in anti-rotating relation by engagement non-rotatably with a rotation preventive engagement projection or a rotation preventive engagement recess formed on or in the connector housing.

[Detailed Description of Invention]

[0001]

[Technical Field to which Invention Pertains]

The present invention relates to a connector anti-rotation device and a connector anti-rotation structure to restrain a connector, for example, which is adapted for assembly in a gasoline fuel piping of an automobile, from relatively rotating with respect to a pipe which is inserted in and connected to the

connector.

[0002]

[Prior Art]

In a gasoline fuel piping for an automobile, a connector may be used for connecting a pipe and a resin tube as a mating member. For example, the connector comprises a tubular connector housing and a retainer. The connector housing is formed with a tube connecting portion on one axial end and a retainer holding portion on the other axial end of the connector housing. The retainer is received or held by the retainer holding portion. In this structure, a resin tube is fitted to the tube connecting portion, the pipe is inserted in the connector housing through an opening of the other axial end of the connector housing or the retainer holding portion to be snap-fitted in the connector, and thereby the pipe and the resin tube are connected each other. The pipe to be connected to the connector includes an inserting side portion of straight tubular shape, and is formed with an annular engagement projection on the inserting side portion to define an inserting end portion. The inserting end portion is inserted in the connector housing, the annular engagement projection snap-engages with the retainer, and thereby the pipe snap-fits in the connector or the connector housing.

[0003]

And, a sealing member is fitted in the connector housing on one axial end with respect to the retainer holding portion to provide a seal between the connector housing and the pipe inserted therein. The sealing member prevents leakage of gasoline fuel between the connector housing and the pipe.

[0004]

Meanwhile, for example, when a resin tube connected to a connector is continued to a gasoline engine of an automobile, the connector or a connector housing continuously rotates at a small angle with respect to a pipe by vibration transmitted from the gasoline engine to the connector via the resin tube, and thereby a sealing member disposed between the connector or the connector housing and the pipe is worn and a sealing property is deteriorated between the connector and the pipe. Therefore, it is preferred to construct an anti-rotation structure in an assembled unit of the pipe and the connector to prevent relative

rotational movement of the connector or the connector housing with respect to the pipe.

[0005]

Then there is a demand for a connector anti-rotation device to restrain relative rotational movement of a connector with respect to a pipe. Known is a connector anti-rotating device to be fitted on a connector so that one end portion thereof clips flat surface regions formed on diametrically symmetrical positions on an outer peripheral surface of the connector or a connector housing and U-shaped cutaway formed on the other end portion thereof receives therein a bent portion of the pipe formed to be bent with respect to a straight tubular portion of the pipe (for example, refer to Patent Document 1). By attachment of this connector anti-rotation device, the pipe and the connector are connected each other in co-rotatable relation, and thereby relative rotational movement of the connector with respect to the pipe may be effectively prevented.

[0006]

[Document 1]

JP, A, 9-269088 (Page 3, Fig. 1)

[0007]

[Problem to be Solved by Invention]

However, if this connector anti-rotation device is adapted, piping design freedom is decreased as a portion on which connection is established by the connector should be arranged near a bent portion of a pipe. And, when bending the pipe, such bending accuracy is required as not to deform a region of the bent portion of the pipe to be received in the cutaway, and that makes troublesome to configure the pipe.

[0008]

Accordingly, it is an object of the present invention to provide a connector anti-rotation device which can effectively prevent relative rotational movement of a connector with respect to a pipe by mounting on an assembled unit of the pipe and the connector without utilizing a bent portion of the pipe, and a connector anti-rotation structure which can effectively prevent relative rotational

movement of a connector with respect to a pipe without utilizing a bent portion of the pipe.

[0009]

[Means to solve Problem]

A connector anti-rotation device of the present invention in order to achieve a foregoing object functions to restrain relative rotational movement of a pipe including an inserting side portion of straight tubular shape and a connector. The connector has a connector housing formed with a connecting portion for a mating member to be connected with the pipe on one axial end of the connector housing. The inserting side portion of the pipe is inserted in the connector housing through an opening of the other axial end thereof and connected to the connector housing. The connector anti-rotation device comprises a pipe connecting portion to be connected to the inserting side portion of the pipe in anti-rotating relation, and a connector connecting portion which is constructed on, for example, constructed integrally on the pipe connecting portion. The connector connecting portion is connected to the connector in anti-rotating relation. As the pipe connecting portion is connected to the pipe in anti-rotating relation and the connector connecting portion is connected to the connector in anti-rotating relation, the pipe and the connector are coupled or connected each other in co-rotatable relation by the connector anti-rotation device. Since the pipe connecting portion is connected not to a bent portion of a pipe but to the straight tubular inserting side portion of the pipe, the connector anti-rotation device constructs an anti-rotation structure between the pipe and the connector without utilizing a bent portion of the pipe. Usually, when the pipe is inserted in and connected to the connector or the connector housing, the other axial end of the inserting side portion of the pipe extends from an opening of the other axial end of the connector housing in the other axial direction (axially outwardly).

[0010]

In many cases, adapted is a pipe formed with an annular engagement projection on an inserting side portion thereof to define an inserting end portion. Thus configured pipe is connected to a connector or a connector housing by inserting the inserting end portion in the connector housing to snap-engage the

annular engagement projection, for example, with a connecting engagement portion of a retainer means. In such case, a connector anti-rotation device may be formed with a verification means having an engagement portion for verification and abutment chips extending in one axial direction, and a connector connecting portion may be mounted on the connector so that the abutment chips are inserted in the connector housing or the connector through an opening of the other axial end thereof, and the engagement portion for verification of the verification means engages in the other axial direction with an engageable portion formed on an axially fixed position of the connector or the connector housing. Here, the abutment chips are formed such that one axial ends thereof are located slightly on the other axial end with respect to the connecting engagement portion of the retainer means when the engagement portion for verification of the verification means engages with the engageable portion of the connector, and the verification means is configured such that the engagement portion for verification is located on the other axial end with respect to the engageable portion of the connector when the abutment chips abut the annular engagement projection of the pipe which does not engage with the connecting engagement portion of the retainer means. This provides the connector anti-rotation device with a function to verify connection of the pipe and the connector.

[0011]

A pipe connecting portion may be configured to be connected to the inserting side portion while tightening the inserting side portion, namely an outer peripheral surface of the inserting side portion in anti-rotating relation. This configuration allows the pipe connecting portion to be connected to the inserting side portion of the pipe in anti-rotating relation, even if the inserting side portion is formed of circle in cross-section. In this configuration, there is no longer need that an outer peripheral surface of the inserting side portion of the pipe is modified in shape, for example, by providing flat regions on diametrically symmetrical positions thereon.

[0012]

And, a pipe connecting portion may be formed of C-shape or C-shape in cross-section. Moreover, the pipe connecting portion may be constructed so as to be

inserted in the other axial end portion of a connector housing through an opening of the other axial end, at that time, and so as to be radially pressed by an inner surface of the other axial end portion of the connector housing to be narrowed in diameter, and thereby to be connected to an inserting side portion of a pipe while tightening the inserting side portion of the pipe in anti-rotating relation. This construction allows the pipe connecting portion to tighten the inserting side portion of the pipe firmly. The pipe connecting portion of C-shape or C-shape in cross-section is mounted or fitted, for example, with a snap action, on an inserting side portion of the pipe (an outer peripheral surface of the inserting side portion). Typically, the pipe connecting portion is fitted on the inserting side portion of the pipe, before it is inserted in the other axial end portion of the connector housing.

[0013]

An elastic material layer may be formed between a pipe connecting portion, for example, an inner surface of the pipe connecting portion and the inserting side portion of the pipe. When the pipe connecting portion tightens the inserting side portion of the pipe so as to compress the elastic member layer sufficiently, non-rotatable connection force between the pipe connecting portion and the pipe can be enhanced by increasing friction therebetween.

[0014]

And a pipe connecting portion may be configured to have a resin or metal spring member (clip member) of C-shape or C-shape in cross-section and a spring engageable portion to engage with the spring member non-rotatably. The spring member is mounted on or connected to an inserting side portion of a pipe while tightening the inserting side portion in non-rotating relation. The spring member is typically mounted on the inserting side portion of the pipe extending from the other axial end of the connector housing in the other axial direction.

[0015]

A connector anti-rotation device according to the present invention may be adapted in order to restrain relative rotational movement of a pipe including an inserting side portion of straight tubular shape and a connector having a connector housing provided with a connecting portion for a mating member to

be connected with the pipe on one axial end of the connector housing and a retainer holding portion for holding a retainer on the other axial end of the connector housing. The inserting side portion of the pipe is inserted in the connector housing through an opening of the other axial end thereof and connected thereto. The inserting side portion of the pipe engages with, for example, snap-engages with the retainer and thereby is connected to the connector housing. The retainer engages with an engagement window formed in the retainer holding portion and is thereby held by the retainer holding portion. The connector anti-rotation device includes a pipe connecting portion which is connected to the inserting side portion of the pipe in anti-rotating relation, and a connector connecting portion which is constructed on the pipe connecting portion and is connected to the connector or the connector housing in anti-rotating relation. The connector connecting portion is configured to be connected to the connector or the connector housing in anti-rotating relation by engagement non-rotatably with the engagement window of the retainer holding portion. If a retainer is provided in a connector for engagement with a pipe, in many cases, an engagement window is formed in a retainer holding portion of a connector housing and the retainer is held by the retainer holding portion via engagement with the engagement window. Therefore, if the connector connecting portion is configured to be connected to the connector housing in anti-rotating relation by utilizing the engagement window, it eliminates the need for modifying a design of a connector or a connector housing.

[0016]

And, in case that; a connector anti-rotation device according to the present invention is adapted in order to restrain rotational movement of a pipe including an inserting side portion of straight tubular shape and a connector having a connector housing provided with a connecting portion for a mating member to be connected with the pipe on one axial end of the connector housing and a retainer holding portion for holding a retainer on the other axial end of the connector housing, the inserting side portion of the pipe is inserted in the connector housing through an opening of the other axial end thereof and connected thereto, the inserting side portion of the pipe engages with the retainer and thereby is connected to the connector housing, the retainer engages, for example, with an engagement window formed in the retainer holding portion and

is thereby held by the retainer holding portion in anti-rotating relation, and the connector anti-rotation device includes a pipe connecting portion which is connected to the inserting side portion of the pipe in anti-rotating relation, and a connector connecting portion which is constructed on the pipe connecting portion and is connected to the connector in anti-rotating relation, the connector connecting portion may be configured to be connected to the connector in anti-rotating relation by engagement with the retainer in anti-rotating relation. In many cases, the retainer is held by the retainer holding portion in anti-rotating relation. Therefore, if the connector connecting portion is engaged with the retainer in anti-rotating relation, the connector or the connector housing and the pipe may be connected each other in co-rotating relation.

[0017]

A connector anti-rotation structure according to the present invention includes a connector anti-rotation device, and is adapted in order to restrain relative rotational movement of a pipe including an inserting side portion of straight tubular shape, and a connector having a connector housing provided with a connecting portion for a mating member to be connected with the pipe on one axial end of the connector housing. The inserting side portion of the pipe is inserted in the connector housing through an opening of the other axial end thereof and connected thereto. The connector anti-rotation device has a pipe connecting portion which is connected to the inserting side portion of the pipe in anti-rotating relation, and a connector connecting portion which is constructed on the pipe connecting portion and is connected to the connector housing in anti-rotating relation. The connector connecting portion is connected to the connector in anti-rotating relation by engagement non-rotatably with a rotation preventive engagement protrusion or a rotation preventive engagement recess formed on or in the connector housing. The rotation preventive engagement recess may be in a form, for example, of a rotation preventive engagement slot or a rotation preventive engagement hole. The connector connecting portion may be formed, for example, with a recess for engagement with the rotation preventive engagement protrusion or a protrusion for engagement in the rotation preventive engagement recess.

[0018]

The connector anti-rotation structure described here constitutes the following invention.

1. A connector anti-rotation structure to restrain relative rotational movement of a pipe and a connector having a connector housing provided with a connecting portion for a mating member to be connected with the pipe on one axial end of the connector housing, the pipe being inserted in the connector housing through an opening of the other axial end thereof and connected thereto, the connector anti-rotation structure including the anti-rotation device for the connector which has a pipe connecting portion which is connected to the pipe in anti-rotating relation, and a connector connecting portion which is constructed on the pipe connecting portion and is connected to the connector in anti-rotating relation, wherein,

the connector connecting portion is located between the other axial end of the connector housing and the pipe and to be connected to the connector in anti-rotating relation by engagement non-rotatably with an inner surface of the connector housing or the retainer received in the connector housing.

[0019]

The connector connecting portion is not necessarily required to be located entirely between the other axial end of the connector housing and the pipe.

[0020]

[Mode for Carrying out Invention]

Now, the embodiments of the present invention will be described with reference to the drawings.

[0021]

Fig. 1 is a perspective view of a first quick connector and a pipe adapted in a first connector anti-rotation structure according to the present invention, Fig. 2 is a sectional view of the first quick connector, Fig. 3 is a perspective view of a retainer (a perspective view best showing a configuration of the retainer), and Fig. 4 is a sectional view showing a state that the first quick connector and the pipe are connected each other.

[0022]

A first quick connector 1, which is adapted for assembly in a gasoline fuel piping of an automobile, comprises a tubular connector housing 3, a generally annular retainer 5 and sealing means 7. The connector housing 3 is made of glass fiber reinforced polyamide (PA · GF) as material, integrally comprises a cylindrical resin tube connecting portion 9 (a connecting portion for a mating member) on one axial end of the connector housing and a generally cylindrical pipe inserting portion 11 on the other axial end of the connector housing, and is provided with a through-bore 13 through from one axial end to the other axial end thereof. The resin tube connecting portion 9 comprises one axial side portion 15 having an outer peripheral surface generally expanding gently in diameter toward the other axial end, and the other axial side portion 21 having an outer peripheral surface extending generally like a cylindrical outer surface on the other axial end with respect to the one axial side portion 15. The other axial side portion 21 is provided on an outer peripheral surface with an annular projecting stop portion 17 of quadrangle in cross-section and two annular projecting stop portions 19, 19 of right-angle triangle in cross-section expanding in diameter toward the other axial end. The annular projecting stop portions 17, 19 are arranged in axially spaced relation sequentially from one axial end to the other axial end of the other axial side portion 21. A resin tube (a mating member) is tightly fitted on and connected to an outer periphery or an outer peripheral surface of the resin tube connecting portion 9. An outer peripheral surface 23 on one axial end of the other axial side portion 21 (a portion between the one axial side portion 15 and the annular projecting stop portion 17) is formed in small diameter or in relatively deep annular groove, and a sealing ring (not shown) is arranged on the outer peripheral surface 23 on one axial end of the other axial side portion 21 when the resin tube is fitted on the resin tube connecting portion 9.

[0023]

The pipe inserting portion 11 of the connector housing 3 integrally comprises a retainer holding portion 25 of large diameter on the other axial end (of the pipe inserting portion 11), a seal holding portion 27 and a link portion 29. The seal holding portion 27 is smaller in diameter than the retainer holding portion 25 and is located in the middle in an axial direction thereof. The link portion 29 is further smaller in diameter than the seal holding portion 27 and is located in one

axial end thereof. In one axial end of an inner peripheral surface of the seal holding portion 27, a first O-ring 31 (sealing member) of one axial end and a second O-ring 33 (sealing member) of the other axial end are fitted with intervening a collar 35 therebetween, namely axially spaced in side by side relation, and in the other axial end of an inner peripheral surface of the seal holding portion 27, a resin bush 37 is fitted. The resin bush 37 is formed in a short tubular shape, and has an inner diameter generally identical to an inner diameter of the link portion 29. The resin bush 37 is provided integrally with annular projecting portions 39, 41 at the other axial end portion and an axial mid portion on an outer peripheral surface thereof respectively. The annular projecting portions 39, 41 are formed so as to project somewhat radially outwardly. The other axial end portion of an inner peripheral surface of the seal holding portion 27 is shaped so as to correspond to a shape of an outer peripheral surface of the resin bush 37. The resin bush 37 is fitted in the other axial end portion of the seal holding portion 27 so that an annular end surface 43 of the other axial end of the resin bush 37 is located at an identical plane to an annular stepped end surface 45 which is formed in inner side of the retainer holding portion 25 on one axial end thereof so as to expand radially inwardly with narrow width. The first O-ring 31 and the second O-ring 33 are axially positioned between the resin bush 37 and an annular stepped surface 47 which is defined on one axial end of an inside of the seal holding portion 27. The first O-ring 31 is, for example, made of fluoro-rubber (FKM) of excellent water-proof and dust-proof properties, high-gasoline resistance and ozone-resistance. The second O-ring 33 is, for example, made of fluoro-silicone-rubber (FVMQ,) of excellent water-proof and dust-proof properties, high low-temperature resistance and ozone-resistance.

[0024]

The generally cylindrical retainer holding portion 25 of the pipe inserting portion 11 is provided with engagement windows 49, 49 in diametrically symmetrical positions and in opposed relation with one another, and flat regions 51, 51 on outer peripheral surfaces respectively between the engagement windows 49, 49 in symmetrical positions. The flat regions 51, 51 of the retainer holding portion 25 are provided with raised portions 53, 53 respectively at a widthwise middle on the other axial end thereof. The raised portion 53

extends in an axial direction from the other axial end of the flat region 51 to a position beyond an axial center of the retainer holding portion 25. In the inner peripheral surface of the retainer holding portion 25, rotation preventive engagement recesses 55 of trapezoid (trapezoid with width widening radially outwardly) in cross-section are formed at positions of the raised portions 53 respectively so as to extend along the raised portions 53 from the other axial end of the retainer holding portion 25 to one axial end portions of the raised portions 53 (also refer to Fig. 5: Fig. 5 is a side elevation view of the first quick connector 1 on a side of the retainer holding portion 25).

[0025]

The retainer 5 made of PA is received and fitted in the retainer holding portion 25. This retainer 5 is relatively flexible, and is configured so as to be resiliently deformable. The retainer 5 has a main body 61 of C-shape in cross-section, wherein a relatively large space for deformation is defined between circumferential opposite end portions 59, 59 thereof. The main body 61 is provided with a pair of engagement tabs 57, 57 projecting radially outwardly in diametrically symmetrical positions of the other axial end portion thereof. An inner surface of the main body 61, except the circumferential opposite end portions 59, 59 and a portion diametrically opposed to the space for deformation, is formed so as to reduce gradually a diameter thereof toward one axial direction. Apart from the circumferential opposite end portions 59, 59 and the portion opposed to the space for deformation, one axial end portion 63 of the main body 61 is formed with an inner diameter almost identical to a pipe 65, and smaller than an annular engagement projection 67. An inner surface 69 of the portion diametrically opposed to the space for deformation of the main body 61 is formed like a cylindrical inner surface and slightly recessed (also refer to Fig 5), and one axial end portion 63 of the portion diametrically opposed to the space for deformation of the main body 61 is formed with a cutaway-like indent 71.

[0026]

A pair of operation arms 73, 73 are formed integrally on the other axial end portion of the main body 61 of the retainer 5 so as to extend inclining radially outwardly in the other axial direction from positions corresponding to the engagement tabs 57, 57. The operation arms 73, 73 have operating end

portions 75, 75 projecting radially outwardly on the other axial end portions thereof. On an outer surface of the other axial end of the main body 61, an engagement rib 77 of trapezoid (trapezoid with width widening radially outwardly) in cross-section is formed at a portion opposed to the space for deformation so as to extend short in an axial direction. The engagement rib 77 is formed narrower than the rotation preventive engagement recess 55. The one axial end portion 63 of the main body 61 is provided with engagement slits 79, 79 extending circumferentially in opposed relation with one another. Thus configured retainer 5 is pushed and fitted in the retainer holding portion 25, so that the engagement rib 77 slidingly moves to and fits in one axial end of the rotation preventive engagement recess 55, the engagement tabs 57, 57 seat in the engagement windows 49, 49 of the retainer holding portion 25 and the operating end portions 75, 75 are received in a pair of receiving recessed portions 81, 81 formed in radially symmetrical positions of the other axial end portion of the retainer holding portion 25. Meanwhile, a reference numeral 83 of Fig. 2 indicates a rotation preventive projection which is formed integrally on the inner peripheral surface of the retainer holding portion 25, and is located in the cutaway-like indent 71 of the main body 61 of the retainer 5 so as to restrain rotational movement of the retainer 5. A similar rotation preventive projection 83 is also formed on the inner peripheral surface of the retainer holding portion 25 in a position diametrically symmetrical to the rotation preventive projection 83 (also refer to Fig. 5), and the similar rotation preventive projection 83 enters between the circumferential opposite end portions 59, 59 of the retainer 5.

[0027]

The retainer 5 is restrained from escape from the retainer holding portion 25 as the engagement tab 57 engages with the other axial end of the engagement window 49, and is restrained from rotational movement with respect to the connector housing 3 or the retainer holding portion 25 as the engagement tab 57 engages with a circumferentially opposite ends of the engagement window 49 and a pair of rotation preventive projections 83 are located in the cutaway-like indent 71 and between the circumferential opposite end portions 59, 59 of the retainer 5, respectively. And, the retainer 5 is firmly and elaborately restrained from rotational movement as the engagement rib 77 is fitted in the rotation preventive engagement recess 55 in engagement relation with one another

circumferentially and radially.

[0028]

The pipe 65, which is, for example, made of metal, is inserted in the first quick connector 1 through an opening 85 of the other axial end of the retainer holding portion 25, more specifically, in the main body 61 of the retainer 5 from a side of the operating end portions 75, 75 of the operation arms 73, 73, and is fitted in the first quick connector 1. The pipe 65 has an inserting side portion 87 of straight tubular shape. One axial end of the inserting side portion 87 is configured as inserting end portion 89 which is provided with the annular engagement projection 67 on an outer peripheral surface thereof. The pipe 65 is pushed into the first quick connector 1 or the connector housing 3 so that the annular engagement projection 67 progresses expanding the main body 61 of the retainer 5 until the annular engagement projection 67 seats in the engagement slits 79, 79 in snap-engagement relation therewith and the inserting end portion 89 is accommodated an entire length thereof in the pipe inserting portion 11 of the connector housing 3. One axial end of the inserting end portion 89 of the pipe 65 reaches in the link portion 29 through the second O-ring 33 and the first O-ring 31, and thereby a seal is formed by the first and second O-rings 31, 33 between the pipe 65 or the inserting end portion 89 of the pipe 65 and the first quick connector 1. Inner diameters of the resin bush 37 and the link portion 29 are generally identical to an outer diameter of the inserting end portion 89 of the pipe 65, and one axial end of the inserting end portion 89 of the pipe 65 with respect to the annular engagement projection 67 is inserted in the resin bush 37 and the link portion 29 without creating play.

[0029]

Fig. 6 is a perspective view of a first connector anti-rotation device adapted in the first connector anti-rotation structure, Fig. 7 is a side elevation view of the first connector anti-rotation device, Fig. 8 is a view explaining a case that the first connector anti-rotation device is mounted on an assembled unit of the first quick connector 1 and the pipe 65, Fig. 9 is a sectional view of the first connector anti-rotation structure, Fig. 10 is another sectional view of the first connector anti-rotation structure, and Fig. 11 is a view explaining a mounting state of the first connector anti-rotation device when the first quick connector 1

and the pipe 65 are in half-fitting relation.

[0030]

A first connector anti-rotation device 91 comprises a pipe connecting portion 97, a stop and verification arm 99 (verification means) with narrow width, a pair of rotation preventive plates 101, 101 (connector connecting portion) of rectangular shape, and a pair of abutment chips 103, 103 (connector connecting portion). The pipe connecting portion 95 includes a C-shaped abutment plate 93 and a tightening portion 95 of C-shape in cross-section which is formed integrally on the abutment plate 93 so as to project short from one axial side surface of the abutment plate 93 in one axial direction. The stop and verification arm 99 is formed integrally on the abutment plate 93 so as to extend somewhat long from an outer periphery of the abutment plate 93 in one axial direction. The rotation preventive plates 101, 101 are formed integrally on the tightening portion 95 so as to extend radially outwardly from diametrically symmetrical positions on an outer peripheral surface of the tightening portion 95, respectively. The abutment chips 103, 103 are formed integrally on the tightening portion 95 so as to extend from one axial end of the tightening portion 95 in one axial direction. The abutment plate 93 has an opening portion 105 with a width somewhat smaller than an outer diameter of the pipe 65, and a tightening recess 107 formed inside the opening portion 105. The tightening recess 107 is formed of about three-quarter arc with a diameter generally identical to the outer diameter of the pipe 65. The tightening portion 95 is formed in tubular shape of about three-quarter arc in cross-section with an opening portion109 identical to the opening portion105 of the abutment plate 93 in width, and integrally on one axial side surface of the abutment plate 93 so as to be along the tightening recess 107 thereof. The tightening recess 107 of the abutment plate 93 and an inner surface of the tightening portion 95 define a continuous tightening inner surface without step, to which a thin elastic material layer 111 made of rubber is overall bonded. The tightening portion 95 is formed with a narrow slit 113 for an entire length thereof on a position opposed to the opening portion 109, and the tightening recess 107 of the abutment plate 93 is formed with a narrow slot 115 continuous with the narrow slit 113 identical to the narrow slit 113 in width and extending radially outwardly with respect to the slit 113 on a position opposed to the opening portion 105. The elastic

material layer 111 is separated circumferentially at the position of the narrow slit 113 and the narrow slot 115.

[0031]

Each of the rotation preventive plates 101, 101 is formed so as to extend for an entire length of the tightening portion 95 in an axial direction, and radially outwardly up to a position of an outer edge of the abutment plate 93, and integrally connected to one axial side surface of the abutment plate 93 at the other axial end thereof. A connecting region between one axial end and radially outer end of the rotation preventive plate 101 is configured in curved line or curved surface bulging outwardly to define a guide. Further, each of the protruding plates 101 is formed so that a distance between radially outer ends thereof is somewhat longer than a distance between bottom surfaces of a pair of the rotation preventive engagement recesses 55, 55 formed in an inner surface of the retainer holding portion 25 of the connector housing 3, and more over, that a thickness is generally identical to a width of the rotation preventive engagement recess 55 at the narrowest region thereof.

[0032]

An outer periphery of the abutment plate 93 is formed with a pair of notch-like recesses 117, 117 with the narrow slot 115 therebetween on a diametrically symmetrical position with respect to the opening portion 105. The stop and verification arm 99 is formed integrally on a portion between the notch-like recesses 117, 117 at radially outer end portion thereof. The stop and verification arm 99 is provided with an engaging claw 119 (engagement portion for verification) on a radially inner side of one axial end portion thereof. An axial length of the stop and verification arm 99, namely an axial distance from one axial side surface of the abutment plate 93 to an engagement surface 121 of the engaging claw 119 is set generally identical to a distance from the other axial end of the connector housing 3 to the other axial end (engageable portion) of the engagement window 49.

[0033]

And, each of the abutment chips 103 is formed so that an axial distance from one axial side surface of the abutment plate 93 to one axial end of the abutment chip 103 is generally identical to an axial distance from the other axial end of the

connector housing 3 to a position somewhat toward the other axial end with respect to the stepped end surface 45 of the retainer holding portion 25, that is, an axial distance from the other axial end of the connector housing 3 to a position slightly toward the other axial end with respect to the engagement slit 79 of the retainer 3 (the engagement slit 79 when the pipe 65 snap-engages therein).

[0034]

In order that the first connector anti-rotation device 91 is mounted on an assembled unit of the first quick connector 1 and the pipe 65, first, the abutment plate 93 and the tightening portion 95 are fitted via the opening portion 105 and the opening portion 109 on an outer periphery of the straight tubular inserting side portion 87 of the pipe 65 which extends axially outwardly (in the other axial direction) with respect to the other axial end of the first quick connector 1 so that the inserting side portion 87 of the pipe 65 is fitted in the tightening recess 107 of the abutment plate 93 and the tightening portion 95 to which the elastic material layer 111 is bonded (Fig. 8a). Although width of the opening portion 105 of the abutment plate 93 and the opening portion 109 of the tightening portion 95 is configured slightly smaller than the outer diameter of the pipe 65, the notch-like recesses 117 and the narrow slot 115 formed in the abutment plate 93, and the narrow slit 113 formed in the tightening portion 95 allow the abutment plate 93 and the tightening portion 95 to readily deform so as to open when the first connector anti-rotation device 91 is fitted on the pipe 65. After the connector anti-rotation device 91 is fitted on an outer periphery of the inserting side portion 87 of the pipe 65, the connector anti-rotation device 91is slid over the inserting side portion 87 of the pipe 65 in one axial direction and moved toward the first quick connector 1 until one axial side surface of the abutment plate 93 abuts the other axial end of the quick connector 1 or the connector housing 3 (Fig. 8b).

[0035]

As the first connector anti-rotation device 91 moves, the tightening portion 95 (and the abutment chips 103) is to be received or inserted in the retainer holding portion 25 of the connector housing 3. In preparation for the tightening portion 95 to be received, the rotation preventive plates 101 are aligned to the rotation preventive engagement recesses 55 formed in an inner peripheral surface of the

retainer holding portion 25. Although a distance between radially outer ends of the rotation preventive plates 101, 101 is slightly longer than a distance between bottom surfaces of the rotation preventive engagement recesses 55, 55, as a guide is defined on the connecting region between one axial end and radially outer end of the rotation preventive plate 101, the rotation preventive plates 101 enter in the rotation preventive engagement recesses 55 with narrowing the tightening portions 95 and the abutment plate 93 in diameter, and progress in one axial direction in the rotation preventive engagement recesses 55. The abutment plate 93 and the tightening portion 95 are readily narrowed in diameter and deformed by the notch-like recesses 117 and the narrow slot 115 formed in the abutment plate 93 and the slit 113 formed in the tightening portion 95. Since a tightening force of the abutment plate 93 and the tightening portion 95 required for the pipe 65 when the rotation preventive plates 101 enter in the rotation preventive engagement recesses 55 is sufficient only to effectively prevent the pipe 65 from slight rotational movement caused by vibration, a difference between the distance between the radially outer ends of the rotation preventive plates 101 and the distance between the bottom surfaces of the rotation preventive engagement recesses 55 is set very small. Therefore, a sliding resistance between the rotation preventive plate 101 and the rotation preventive engagement recess 55 is not so large, and the first connector anti-rotation device 91 is slidable over the pipe 65 even after the rotation preventive plate 101 enters in the rotation preventive engagement recess 55.

[0036]

Then one axial side surface of the abutment plate 93 is abutted to the other axial end of the connector housing 3, the engaging claw 119 (the engagement surface 121 of the engaging claw 119) of the stop and verification arm 99 is engaged with one axial end of the engagement window 49 (engageable portion), and the first connector anti-rotation device 91 is completely mounted. The first connector anti-rotation device 91 is mounted on the assembled unit of the first quick connector 1 and the pipe 65 so as not to be displaced with respect to the first quick connector 1 in the other axial direction by the engaging claw 119 of the stop and verification arm 99 engaging with the engagement window 49, not to rotate with respect to the first quick connector 1 by the rotation preventive plate 101 seating in and engaging with the rotation preventive engagement

recess 55, and not to rotate with respect to the pipe 65 by the tightening portion 95 and the abutment plate 93 tightening the pipe 65. When the first connector anti-rotation device 91 is mounted on the assembled unit, the tightening portion 95 is received in the retainer holding portion 25 on the other axial end with respect to the main body 61 of the retainer 5, while the abutment chips 103 are received between circumferentially opposite ends 59, 59 and in the recessed inner surface 69 of the main body 61, respectively. Therefore, the abutment chips 103 engage non-rotatably with the retainer 5 which is fitted in the retainer holding portion 25 of the connector housing 3 in anti-rotating relation therewith. Non-rotatable engagement of the abutment chip 103 with the retainer 5, and hence with the first quick connector 1 also allows the first connector anti-rotation device 91 to be mounted on the first quick connector 1 in non-rotating relation. And, if a width of the stop and verification arm 99 or the engaging claw 119 is made equal to a width of the engagement window 49, the stop and verification arm 99 engages with connector housing 3 or the first quick connector 1 in non-rotating relation. So, non-rotatable engagement relation between the stop and verification arm 99 and the first quick connector 1 also allows the connector anti-rotation device 91 to be mounted on the first quick connector 1 in anti-rotating relation therewith. Here, three types of connector connecting portions are defined in order to enhance anti-rotating effect. However, one or two types of the connector connecting portions may be adapted to connect the first connector anti-rotation device 91 on the first quick connector 1.

[0037]

By the way, when the rotation preventive plate 101 enters in the rotation preventive engagement recess 55, the tightening portion 95 and the abutment plate 93 tighten the pipe 65. Therefore, when the fist connector anti-rotating device 91 is moved in one axial direction, a pull force is exerted on the pipe 65 in one axial direction. So, if there is a half-fitting relation where the annular engagement projection 67 of the pipe 65 does not snap-engage in the engagement slit 79 of the retainer 5, the pipe 65 moves in one axial direction, following movement of the first connector anti-rotating device 91 in one axial direction, and the annular engaging projection 67 snap-engages in the engagement slit 79 of the retainer 5. Further, tightening force of the tightening

portion 95 and the abutment plate 93 to the pipe 65 is sufficient only to restrain slight rotational movement of the pipe 65 and the first connector 1 caused by vibration, and is not so large. Hence, even if the first connector anti-rotation device 91 is moved in one axial direction, there could be a possibility that the annular engagement projection 67 does not snap-engage in the engagement slit 79 of the retainer 5. However, in this case, one axial end of the abutment chip 103 abuts the annular engagement projection 67 before the engaging claw 119 of the stop and verification arm 99 engages with the engagement window 49 (refer to Fig. 11). Therefore, if the first connector anti-rotation device 91 is forcedly pushed toward one axial direction so as to engage the engaging claw 119 with the engagement window 49, the annular engagement projection 67 is moved in one axial direction and consequently snap-engages in the engagement slit 79. And, in case that the abutment chip 103 abuts the annular engagement projection 67 of the pipe 65 before the tightening portion 95 and the abutment plate 93 tighten the pipe 65, the annular engagement projection 67 is pushed with the abutment chip 103, moved in one axial direction by pushing the first connector anti-rotation device 91 in one axial direction, and consequently snap-engages in the engagement slit 79 (refer to Fig. 11). That is, the first connector anti-rotation device 91 has a connection assist function to assist correct fit-in connection of a pipe. Here, if the engaging claw 119 cannot be engaged with the engagement window 49 by forcedly pushing the first connector anti-rotation device 91 in one axial direction, the pipe 65 is forcedly pushed in the connector housing 3, and then the first connector anti-rotation device 91 is pushed again to engage the engaging claw 119 with the engagement window 49. As such, when the annular engagement projection 67 does not snap-engage in the engagement slit 79 of the retainer 5, due to abutment of the abutment chip 103 with the annular engagement projection 67 which is located relatively toward the other axial end compared to when the pipe 65 and the first quick connector 1 are connected each other correctly, the connector anti-rotation device 91 cannot be moved relatively toward the first quick connector 1 until the engaging claw 119 of the stop and verification arm 99 reaches the engagement window 49, and therefore the engaging claw 119 cannot be engaged with the engagement window 49. Thus, the stop and verification arm 99 or the first connector anti-rotation device 91 has a function to verify correct connection with the pipe 67.

[0038]

The first anti-rotation device for the connector 91 can be removed from the assembled unit of the first quick connector 1 and the pipe 65 by releasing engagement of the engaging claw 119 of the stop and verification arm 99 with the engagement window 49, and then pulling the first connector anti-rotation device 91 out of the retainer holding portion 25 of the connector housing 3, and can be again mounted on the assembled unit.

[0039]

Meanwhile, as shown with phantom lines in Fig. 8, a strip 123 for combining purpose may be fitted to an outer periphery of the retainer holding portion 25 at one end portion thereof and to the stop and verification arm 99 at the other end portion thereof so as to always keep the first quick connector 1 and the first connector anti-rotation device 91 in combination relation with one another. The strip 123 for combining purpose is fitted or mounted to an outer periphery of the retainer holding portion 25, for example, by using a raised or recessed portion (for example, the elongate rib 125) formed on the retainer holding portion 25 for reason such as addition of another function.

[0040]

Fig. 12 is a perspective view of a second quick connector adapted in a second connector anti-rotation structure, Fig. 13 is a perspective view of a second connector anti-rotation device adapted in the second connector anti-rotation structure, Fig. 14 is a sectional view of the second connector anti-rotation structure, and Fig. 15 is a view explaining a mounting state of the second connector anti-rotation device when the second quick connector and the pipe 65 are in half-fitting relation.

[0041]

A second connector anti-rotation structure is configured by modifying configuration of the first quick connector 1 and the first connector anti-rotation device 91 in the first connector anti-rotation structure, as to portions of identical configuration and identical functions, identical numeral references are almost given and explanations are omitted herein. The second quick connector 127, which is adapted in the second connector anti-rotation structure, is constructed

by modifying configuration of the connector housing 3 of the first quick connector 1. The retainer holding portion 25 of the connector housing 129 is provided with engagement protrusions 131, 131 (engageable portion) between one axial end thereof and the engagement windows 49 on an outer peripheral surface thereof, respectively. The engagement protrusion 131 includes a radially outer surface, and the radially outer surface is defined by a ramped outer surface 133 that extends inclining radially outwardly from one axial end of the engagement window 49 in one axial direction, and a slide outer surface 135 that extends short from one axial end of the ramped outer surface 133 in one axial direction. The engagement protrusion 131 also includes an engagement outer surface 139 that extends radially inwardly from one axial end of the slide outer surface 135 and is connected to an outer end surface 137 of one axial end of the retainer holding portion 25. The engagement outer surface 139 is formed at an identical plane to the outer end surface 137 of one axial end of the retainer holding portion 25. The radially outer surface of the engagement protrusion 131 is formed in arc expanding radially outwardly in cross-section taken perpendicular to an axis.

[0042]

A second connector anti-rotation device 141, which is adapted in the second connector anti-rotation structure, is configured by modifying configuration of the stop and verification arm 99 of the first connector anti-rotation device 91. In the second connector anti-rotation device 141, a stop and verification arm 143 (verification means) extends long from an outer periphery of the abutment plate 93 in one axial direction, has an engageable hole 145 (engagement portion for verification) bored through radially on an axial center portion thereof. An axial distance from one axial side surface of the abutment plate 93 to one axial end of the engageable hole 145 is set generally identical to an axial distance from the other axial end of the connector housing 129 to the engagement outer surface 139 of the engagement protrusion 131. And, a radially inner surface of the stop and verification arm 143 is formed in arc recessed radially outwardly in cross-section taken perpendicular to an axis so as to correspond to a radially outer surface of the engagement protrusion 131 and an outer peripheral surface of the retainer holding portion 25.

[0043]

In order that the second connector anti-rotation device 141 is mounted on an assembled unit of the second quick connector 127 and the pipe 65, just like the first connector anti-rotation device 91, the abutment plate 93 and the tightening portion 95 are fitted on an outer periphery of the straight tubular inserting side portion 87 of the pipe 65, and the second connector anti-rotation device 141 is slid over the inserting side portion 87 of the pipe 65 in one axial direction, and is moved until one axial side surface of the abutment plate 93 abuts the other axial end of the quick connector 127 or the connector housing 129 so that the engagement protrusion 131 is engaged in the engageable hole 145 of the stop and verification arm 143. In process of mounting the second connector anti-rotation device 141, as the connector anti-rotation device 141 is moved in one axial direction, one axial end of the stop and verification arm 143 abuts the ramped outer surface 133 of the engagement protrusion 131. As the connector anti-rotation device 141 is moved further in one axial direction, one axial end of the stop and verification arm 143 is guided by the ramped outer surface 133 and a radially inner surface becomes in contact relation with the slide outer surfaces 139. And, the stop and verification arm 143 is further slid and moved over the slide outer surfaces 139 until the second connector anti-rotation device 141 is completely mounted on the assembled unit. Similarly to the stop and verification arm 99, although the stop and verification arm 143 has functions as stopper and as checker to verify connection, the stop and verification arm 143 is configured such that engagement between the engageable hole 145 and the engagement protrusion 131 can be easily released by moving the stop and verification arm 143 so as to lift up one axial end portion thereof radially outwardly, as one axial end thereof extends beyond and long from the engagement protrusion 131. Moreover, if the engageable hole 145 and the engagement protrusion 131 are made of equal width, the stop and verification arm 143 functions as a connector connecting portion similarly to the stop and verification arm 99. Similarly to the first connector anti-rotation device 91, the second connector anti-rotation device 141 has functions to assist and verify the connection.

[0044]

Fig. 16 is a perspective view of a third connector anti-rotation device adapted in a third connector anti-rotation structure, Fig. 17 is a view explaining a case

that the third connector anti-rotation device is mounted on the assembled unit of the first quick connector 1 and the pipe 65. Fig. 18 is a perspective view of the third connector anti-rotation structure, and Fig. 19 is a sectional view showing a connecting state of the anti- rotation fitting.

[0045]

The third connector anti-rotation structure is configured by modifying configuration of the first connector anti-rotation device 91 in the first connector anti-rotation structure, as to portions of identical configuration and functions, identical numeral references are almost given and explanations are omitted herein. The third connector anti-rotation device 147 which is adapted in the third connector anti-rotation structure comprises a pipe connecting portion 157, stop and verification arm 99 with narrow width, a pair of rotation preventive plates 101, 101 of rectangular shape, and a pair of abutment chips 103, 103. The pipe connecting portion 157 includes a C-shaped abutment plate 149, a fit-on portion 151 of C-shape in cross-section which is provided integrally on the abutment plate 149 so as to project short from one axial side surface of the abutment plate 149 in one axial direction, a fitting receiving frame 153 (spring engageable portion) that is provided integrally on the abutment plate 149 so as to project short from the other axial side surface of the abutment plate 149 in the other axial direction, and a rotation preventive fitting 155 (spring member) that is arranged on the fitting receiving frame 153. The stop and verification arm 99 is provided integrally on the abutment plate 149 so as to extend somewhat long from an outer periphery of the abutment plate 149 in one axial direction. The rotation preventive plates 101, 101 are formed integrally on the fit-on portion 151 so as to extend radially outwardly from diametrically symmetrical positions on an outer peripheral surface of the fit-on portion 151, respectively. The abutment chips 103, 103 are provided integrally on the fit-on portion 151 so as to extend from one axial end of the fit-on portion 151 in one axial direction. The abutment plate 149 has configuration identical to the abutment plate 93 except that the abutment plate 149 does not have the narrow slot 115 and the elastic material layer 111, while the fit-on portion 151 has configuration identical to the tightening portion 95 except that the fit-on portion 151 does not have the slit 113 and the elastic material layer 111. Therefore, even when the rotation preventive plate 101 enters in the rotation preventive engagement recess

55 in an inner peripheral surface of the retainer holding portion 25, the fit-on portion 151 and the abutment plate 149 are never deformed so as to effectively tighten the pipe 65.

[0046]

The fitting receiving frame 153 comprises three frame members 159 of triangle in cross-section extending short from the other axial side surface of the abutment plate 149 in the other axial direction, and a C-shaped ring 161 integrally connected to the frame members 159 on the other axial ends of the frame members 159. Two of three frame members 159 are disposed as abutment members 159a in opposed relation each other, with inner surfaces thereof along portions adjacent to the receiving recess 107 in the opening portion 105 of the abutment plate 93, and one frame member 159 is disposed as fit-in member 159b with inner surface thereof along a region of the receiving recess 107 opposed to the opening portion 105. In the C-shaped ring 161, an inner peripheral surface is formed of about three-quarter arc with diameter identical to that of the receiving recess 107 of the abutment plate 93, and opening portion 163 has a width identical to that of the opening portion 105 of the abutment plate 149.

[0047]

The rotation preventive fitting 155 is in a form of a spring body formed in C-shape in cross-section with length generally identical to the frame member 159, and includes a projecting part 167 projecting radially outwardly in triangle shape in a position opposed to the opening portion 165, and the opening portion 165 is bent radially outwardly at each side thereof so as to correspond to abutment surfaces of the abutment members 159a located on an end of the fit-in member 159b. Press-contact portions 169 of the rotation preventive fitting 155 between the projecting part 167 and the opening portion 165 tighten the pipe 65, respectively by press-contact with an outer peripheral surface of the pipe 65 when the rotation preventive fitting 155 are fitted on the pipe 65.

[0048]

In order that the third connector anti-rotation device 147 is mounted on an assembled unit of the first quick connector 1 and the pipe 65, first, the abutment plate 149, the fit-on portion 151, and the C-shaped ring 161 (or the fitting

receiving frame 153) are fitted via the opening portions105, 109 and 163 on an outer periphery of the straight tubular inserting side portion 87 of the pipe 65 which extends axially outwardly (in the other axial direction) with respect to the other axial end of the first quick connector 1 so that the inserting side portion 87 of the pipe 65 is fitted in the receiving recess 107 of the abutment plate 149, the fit-on portion 151 and the C-shaped ring 161 (Fig. 17a). Although width of the opening portion 105 of the abutment plate 149 is configured slightly smaller than an outer diameter of the pipe 65, the recesses 117 formed in the abutment plate 149 allow the abutment plate 149 to relatively readily deform so as to open when the abutment plate 149 is fitted to the pipe 65. After the abutment plate 149, the fit-on portion 151 and the fitting receiving frame 153 are fitted on an outer periphery of the inserting side portion 87 of the pipe 65, the abutment plate 149, the fit-on portion 151 and the fitting receiving frame 153 are slid over the inserting side portion 87 of the pipe 65 in one axial direction, and is moved until one axial side surface of the abutment plate 149 abuts the other axial end of the first quick connector 1 or the connector housing 3 (Fig. 17b). As the abutment plate 149, the fit-on portion 151 and the fitting receiving frame 153 move, the fit-on portion 151 (and the abutment chips 103) is to be received or inserted in the retainer holding portion 25 of the connector housing 3. In preparation for the fit-on portion 151 to be received, the rotation preventive plates 101 are aligned to the rotation preventive engagement recesses 55 formed in an inner peripheral surface of the retainer holding portion 25.

[0049]

Then one axial side surface of the abutment plate 149 is abutted to the other axial end of the connector housing 3, the engaging claw 119 of the stop and verification arm 99 is engaged with one axial end of the engagement window 49. In this state, the rotation preventive fitting 155 is fitted on the inserting side portion 87 of the pipe 65 between the abutment plate 149 and the C-shaped ring 161 so that the fit-in member 159b fits in the projecting part 167 (refer to Fig. 17b). Then the press-contact portions 169 of the rotation preventive fitting 155 tighten the inserting side portion 87 of the pipe 65, while the opening portion 165 of the rotation preventive fitting 155 abuts or approaches abutment surfaces of the abutment member 159a. Therefore, the rotation preventive fitting 155 is joined to the pipe 65 in anti-rotating relation, and engages with the fitting

receiving frame 153 in anti-rotating relation. In this manner, the first quick connector 1 and the pipe 65 are connected by the third connector anti-rotation device 147 in co-rotatable relation with one another.

[0050]

The third connector anti-rotation device 147 can be removed from the assembled unit of the first quick connector 1 and the pipe 65 by pulling the rotation preventive fitting 155 out of the pipe 65 and the fitting receiving frame 153, releasing engagement between the engaging claw 119 of the stop and verification arm 99 and the engagement window 49, and then pulling the third connector anti-rotation device 147 out of the retainer holding portion 25 of the connector housing 3, and can be again mounted on the assembled unit. The third connector anti-rotation device 147 has functions to assist and verify connection like the first connector anti-rotation device 91 except not to exert a large pulling force on the pipe 65.

[0051]

Fig. 20 is a perspective view of a fourth connector anti-rotation device adapted in a fourth connector anti-rotation structure, and Fig. 21 is a sectional view of the fourth connector anti-rotation structure.

[0052]

A forth connector anti-rotation structure is configured by modifying configuration of the first quick connector 1 and the third connector anti-rotation device 147 in the third connector anti-rotation structure, as to portions of identical configuration and identical functions, identical numeral references are almost given and explanations are almost omitted herein. In the forth connector anti-rotation structure, the second quick connector 127 is adapted.

[0053]

A forth connector anti-rotation device 171, which is adapted for the forth connector anti-rotation structure, is configured by modifying configuration of the stop and verification arm 99 of the third connector anti-rotation device 147. In the forth connector anti-rotation device 171, a stop and verification arm 173 extends long in one axial direction from an outer periphery of the abutment plate 149 and has an engageable hole 175 bored through radially on an axial center

portion thereof. An axial distance from one axial side surface of the abutment plate 149 to one axial end of the engageable hole 175 is set generally identical to an axial distance from the other axial end of the connector housing 129 to the engagement outer surface 139 of the engagement protrusion 131. And, a radially inner surface of the stop and verification arm 173 is formed in arc recessed radially outwardly in cross-section taken perpendicular to an axis so as to correspond to a radially outer surface of the engagement protrusion 131 and an outer peripheral surface of the retainer holding portion 25. If the engageable hole 175 and the engagement protrusion 131 are made of equal width, the stop and verification arm 173 functions as a connector connecting portion similarly to the stop and verification arm 99.

[0054]

In order that the forth connector anti-rotation device 171 is mounted on an assembled unit of the second quick connector 127 and the pipe 65, just like the third connector anti-rotation device 147, the abutment plate 149, the fit-on portion 151, and the C-shaped ring 161 (or the fitting receiving frame 153) are fitted on an outer periphery of the straight tubular inserting side portion 87 of the pipe 65, then, the abutment plate 149, the fit-on portion 151 and the C-shaped ring 161 are slid over the inserting side portion 87of the pipe 65 in one axial direction, and is moved until one axial side surface of the abutment plate 149 abuts the other axial end of the quick connector 127 or the connector housing 129 so that the engagement protrusion 131 is engaged in the engageable hole 175 of the stop and verification arm 173. Similarly to the stop and verification arm 99, although the stop and verification arm 173 has functions as stopper and as checker to verify connection, the stop and verification arm 173 is configured such that engagement between the engageable hole 175 and the engagement protrusion 131 can be easily released by moving the stop and verification arm 173 so as to lift up one axial end portion thereof radially outwardly, as one axial end thereof extends beyond and long from the engagement protrusion 131. Similarly to the third connector anti-rotation device 147, the forth connector anti-rotation device 171 has functions to assist and verify connection.

[0055]

[Effect of Invention]

As explained above, when a connector anti-rotation device and a connector anti-rotation structure of the present invention is used, an assembled unit of a connector and a pipe can be unified in co-rotating relation, even without utilizing a bent portion of the pipe.

[Brief Description of Drawings]

[Fig. 1]

Fig. 1 is a perspective view of a first quick connector and a pipe adapted in a first connector anti-rotation structure according to the present invention.

[Fig. 2]

Fig. 2 is a sectional view of the first quick connector.

[Fig. 3]

Fig. 3 is a perspective view of a retainer.

[Fig. 4]

Fig. 4 is a sectional view showing a state that the first quick connector and the pipe are connected each other.

[Fig. 5]

Fig. 5 is a side elevation view of the first quick connector on a side of a retainer holding portion.

[Fig. 6]

Fig. 6 is a perspective view of a first connector anti-rotation device adapted in the first connector anti-rotation structure.

[Fig. 7]

Fig. 7 is a side elevation view of the first connector anti-rotation device.

[Fig. 8]

Fig. 8 is a view explaining when the first connector anti-rotation device is mounted on an assembled unit of the first quick connector and the pipe.

[Fig. 9]

Fig. 9 is a sectional view of the first connector anti-rotation structure.

[Fig. 10]

Fig. 10 is another sectional view of the first connector anti-rotation structure.

[Fig. 11]

Fig. 11 is a view explaining a mounting state of the first connector anti-rotation device when the first quick connector and the pipe are in half-fitting relation.

[Fig. 12]

Fig. 12 is a perspective view of a second quick connector adapted in a second connector anti-rotation structure.

[Fig. 13]

Fig. 13 is a perspective view of a second connector anti-rotation device adapted in the second connector anti-rotation structure.

[Fig. 14]

Fig. 14 is a sectional view of the second connector anti-rotation structure.

[Fig. 15]

Fig. 15 is a view explaining a mounting state of the second connector anti-rotation device when the second quick connector and the pipe are in half-fitting relation.

[Fig. 16]

Fig. 16 is a perspective view of a third connector anti-rotation device adapted in a third connector anti-rotation structure.

[Fig. 17]

Fig. 17 is a view explaining when the third connector anti-rotation device is mounted on the assembled unit of the first quick connector and the pipe.

[Fig. 18]

Fig. 18 is a perspective view of the third connector anti-rotation structure.

[Fig. 19]

Fig. 19 is a sectional view showing a connecting state of an anti- rotation fitting.

[Fig. 20]

Fig. 20 is a perspective view of a fourth connector anti-rotation device adapted in a fourth connector anti-rotation structure.

[Fig. 21]

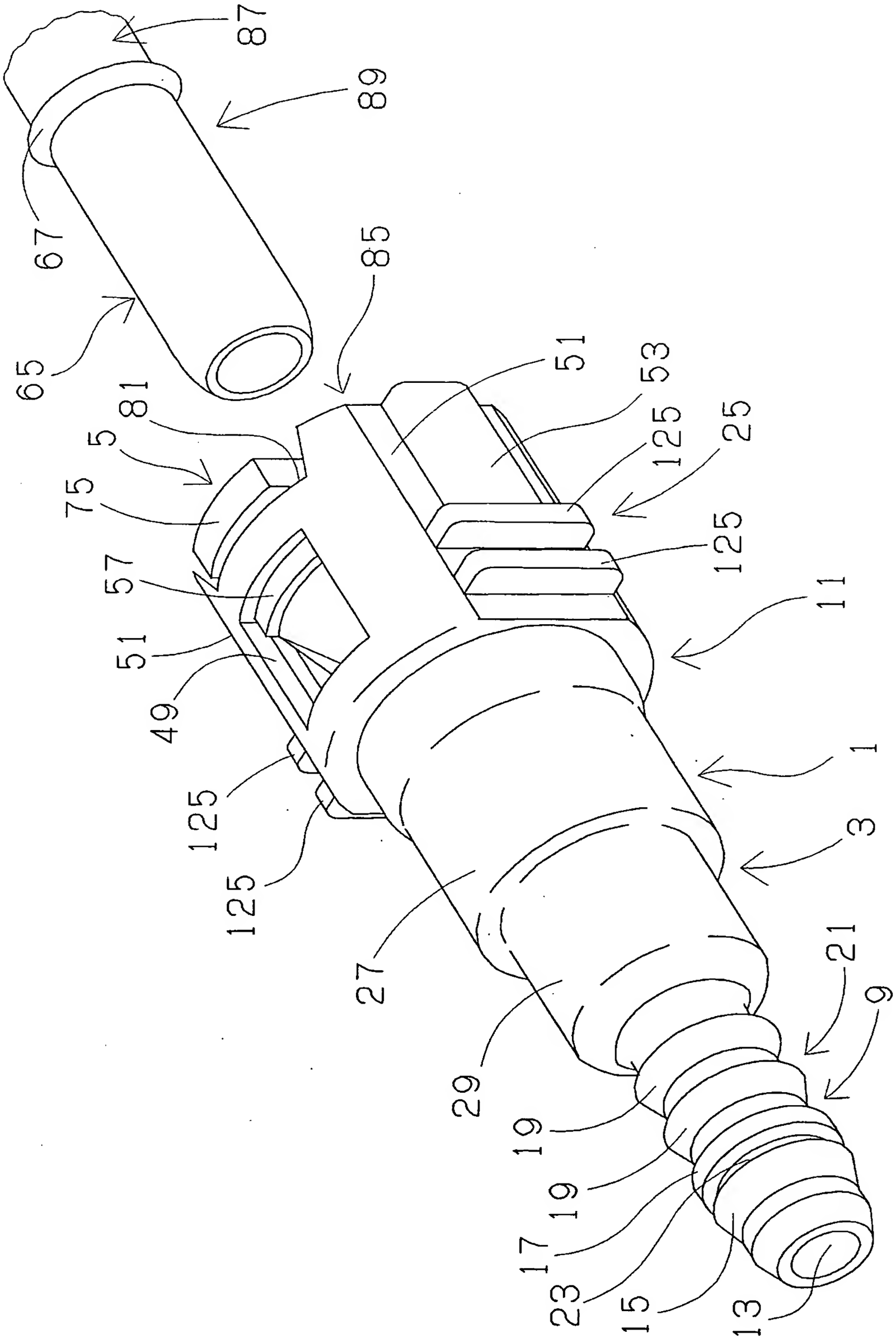
Fig. 21 is a sectional view of the fourth connector anti-rotation structure.

[Explanations of Reference Numerals]

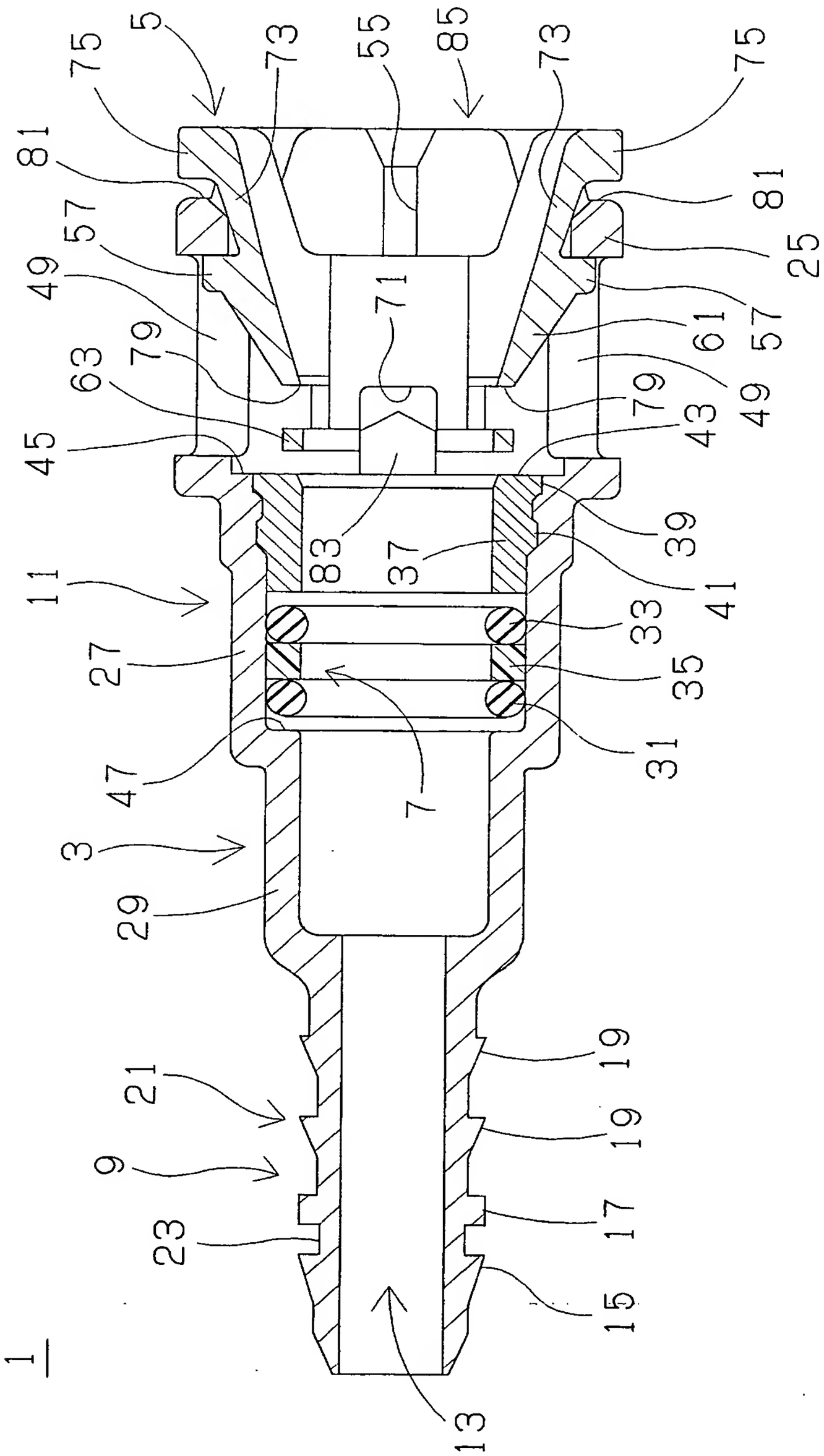
1, 127	Quick connector
3, 129	Connector housing
9	Resin tube connecting portion (connecting portion with a mating member)
65	Pipe
85	Opening of the other axial end
87	Inserting side portion
91, 141, 147, 171	Connector anti-rotation device
97, 157	Pipe connecting portion
101	Rotation preventive plate (connector connecting portion)
103	Abutment chip (connector connecting portion)

[Name of Document] Drawing

[FIG.1]



[FIG.2]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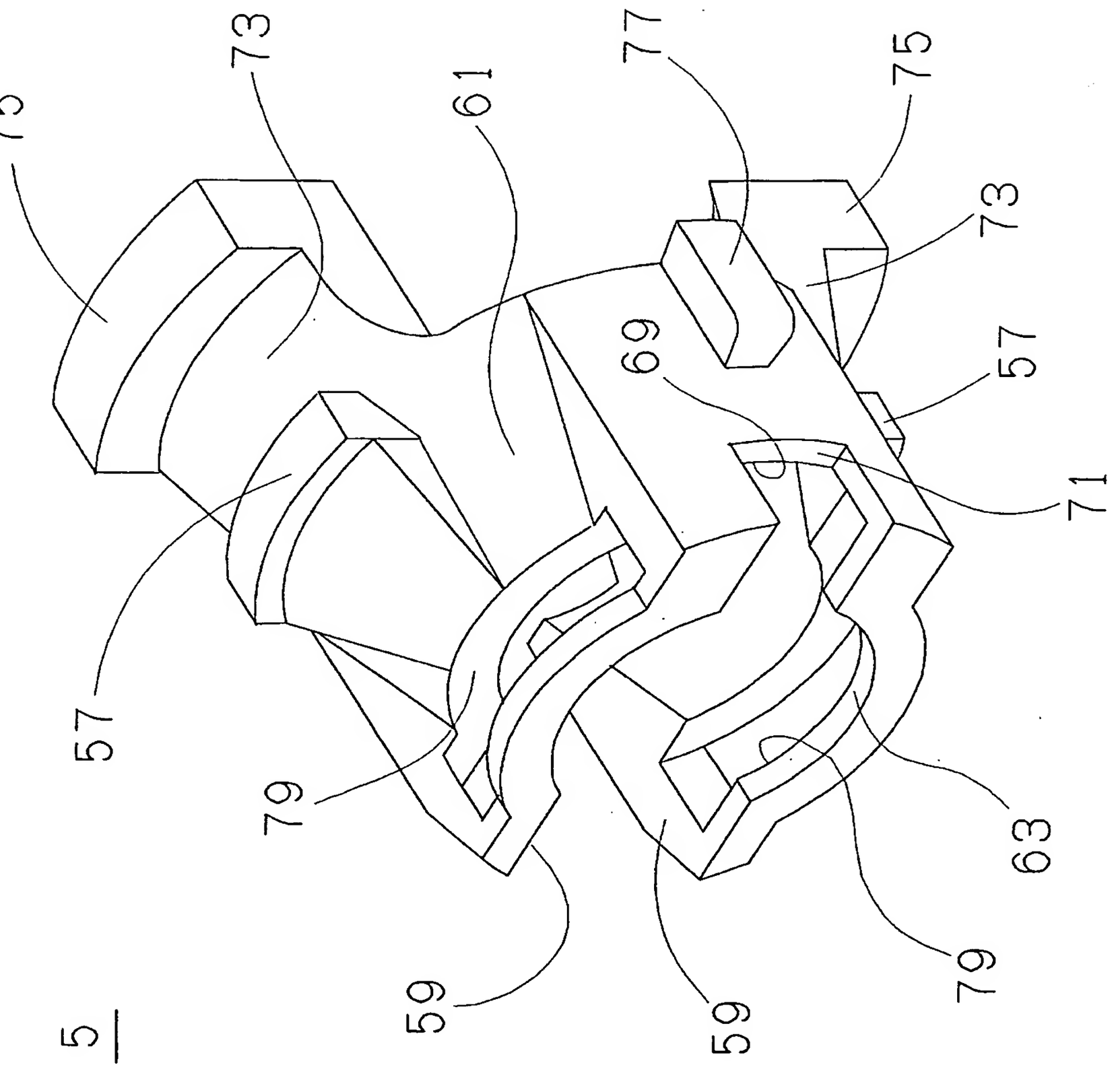
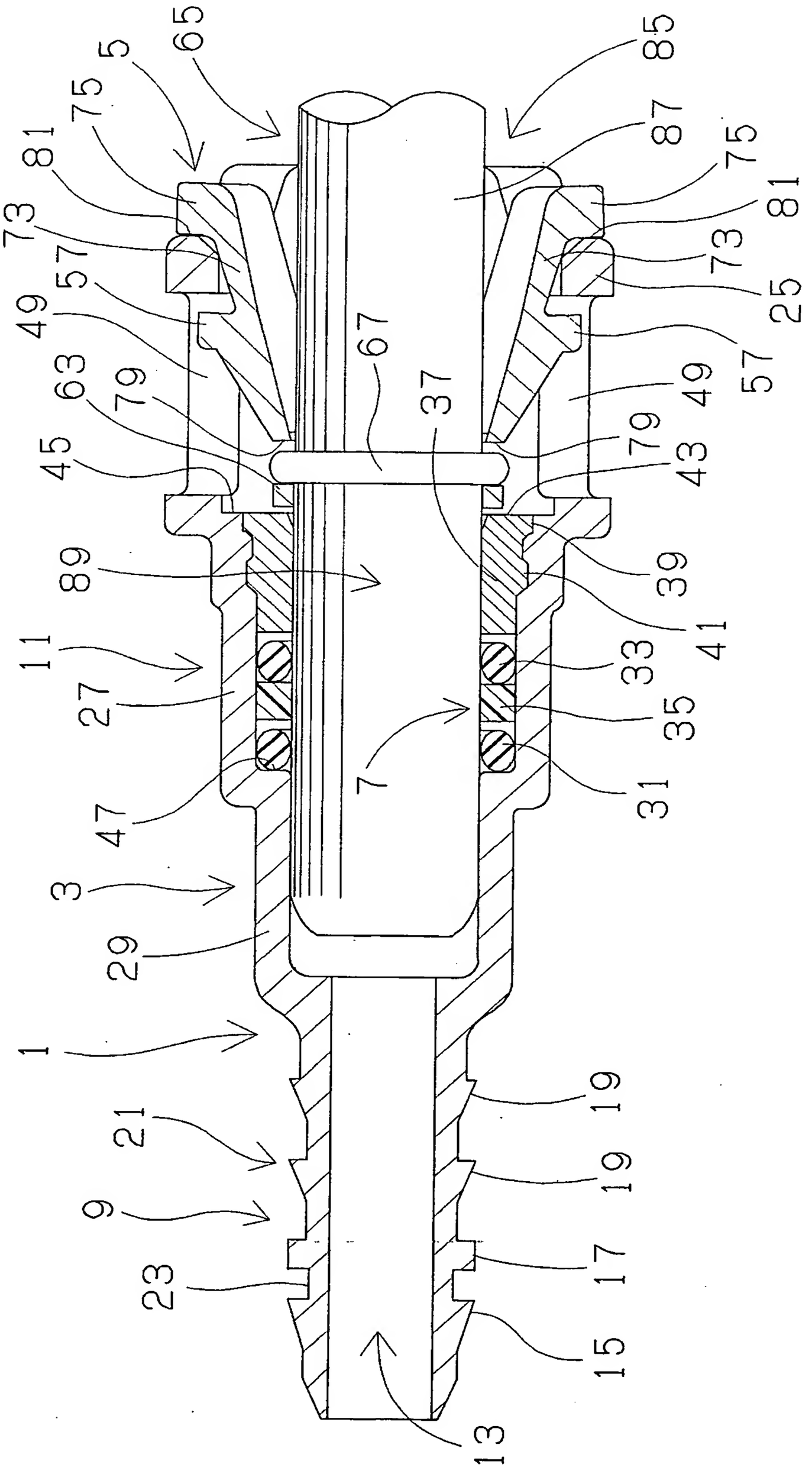
[FIG.3]



[FIG.4]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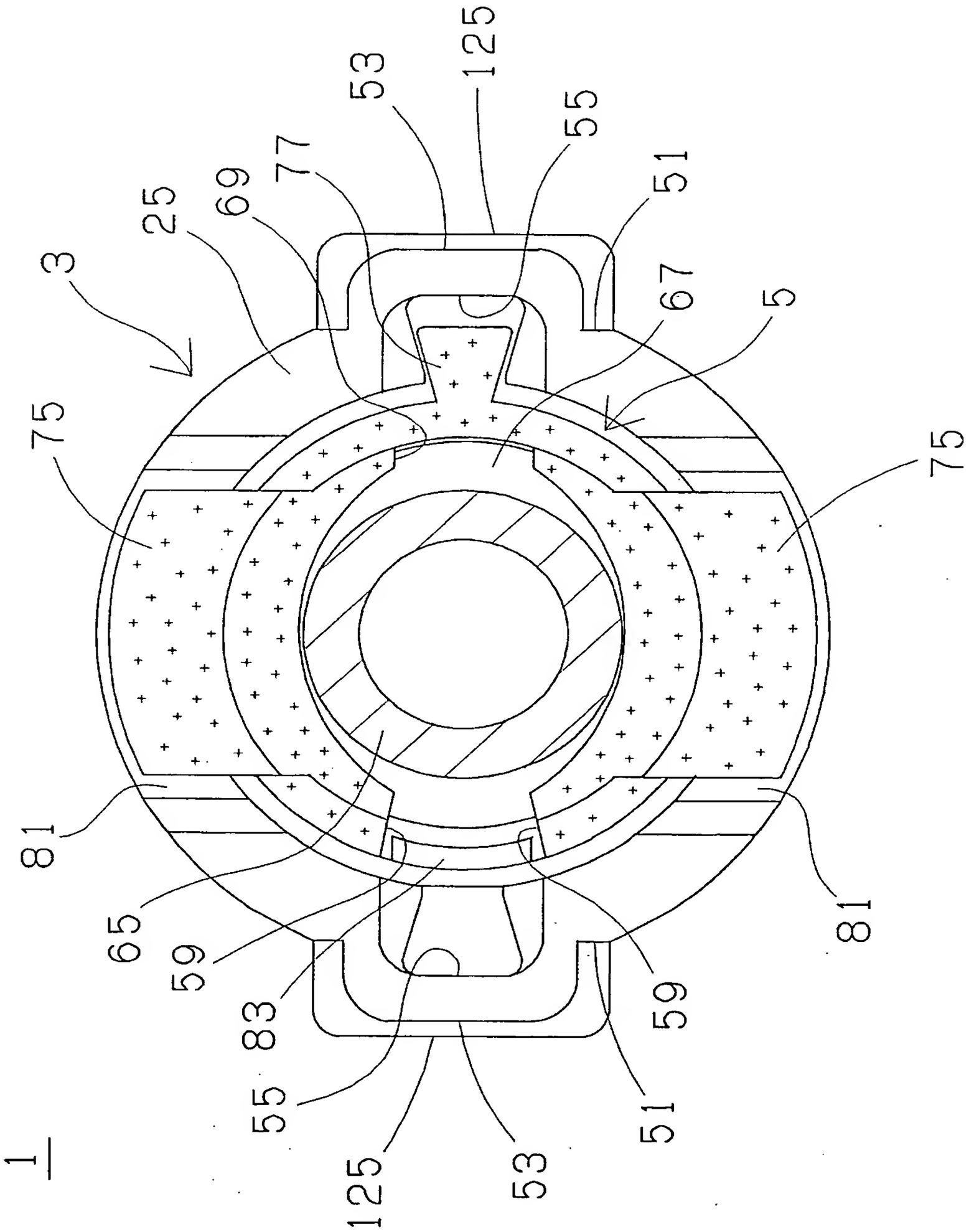
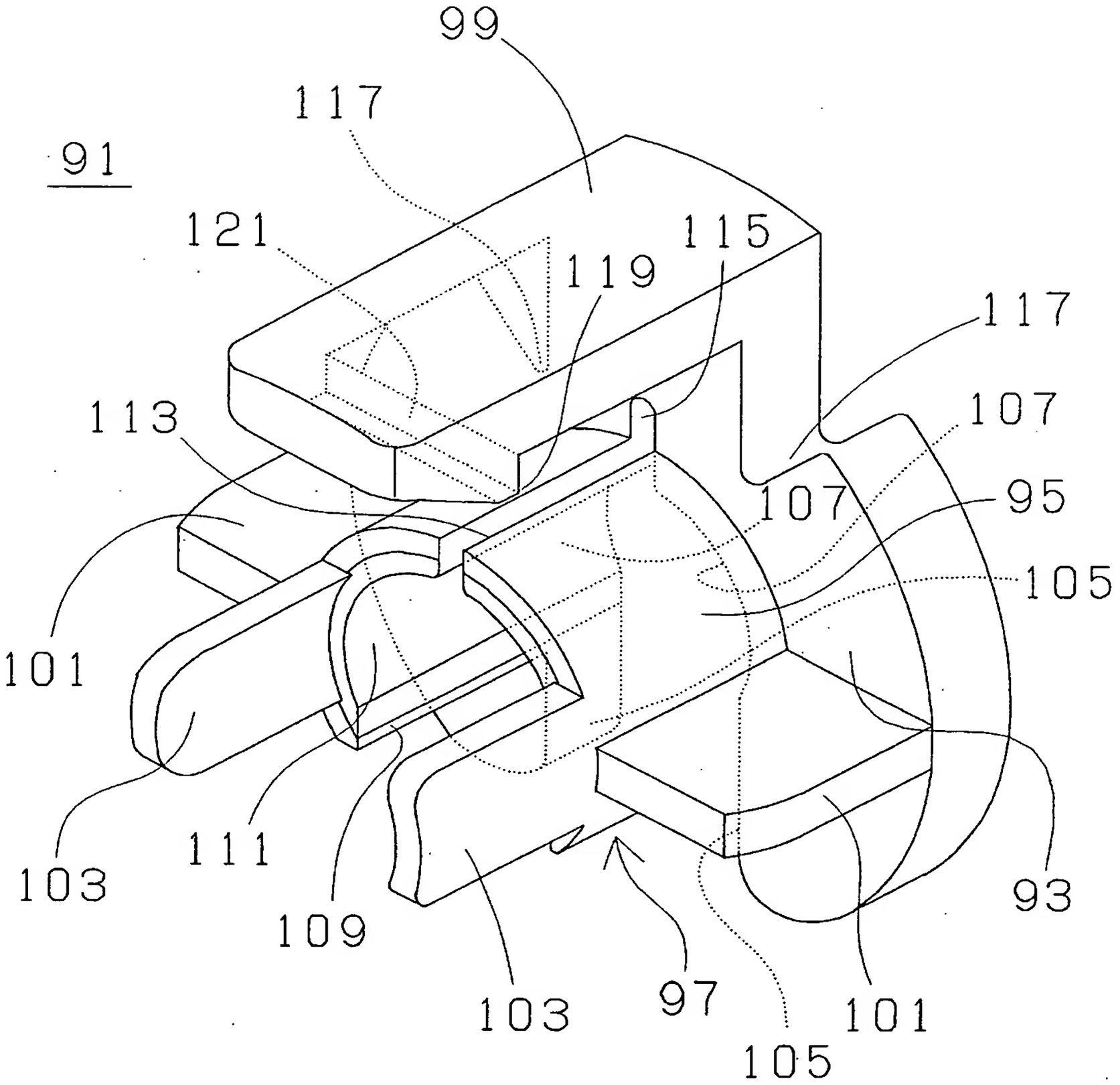
[FIG.5]



[FIG.6]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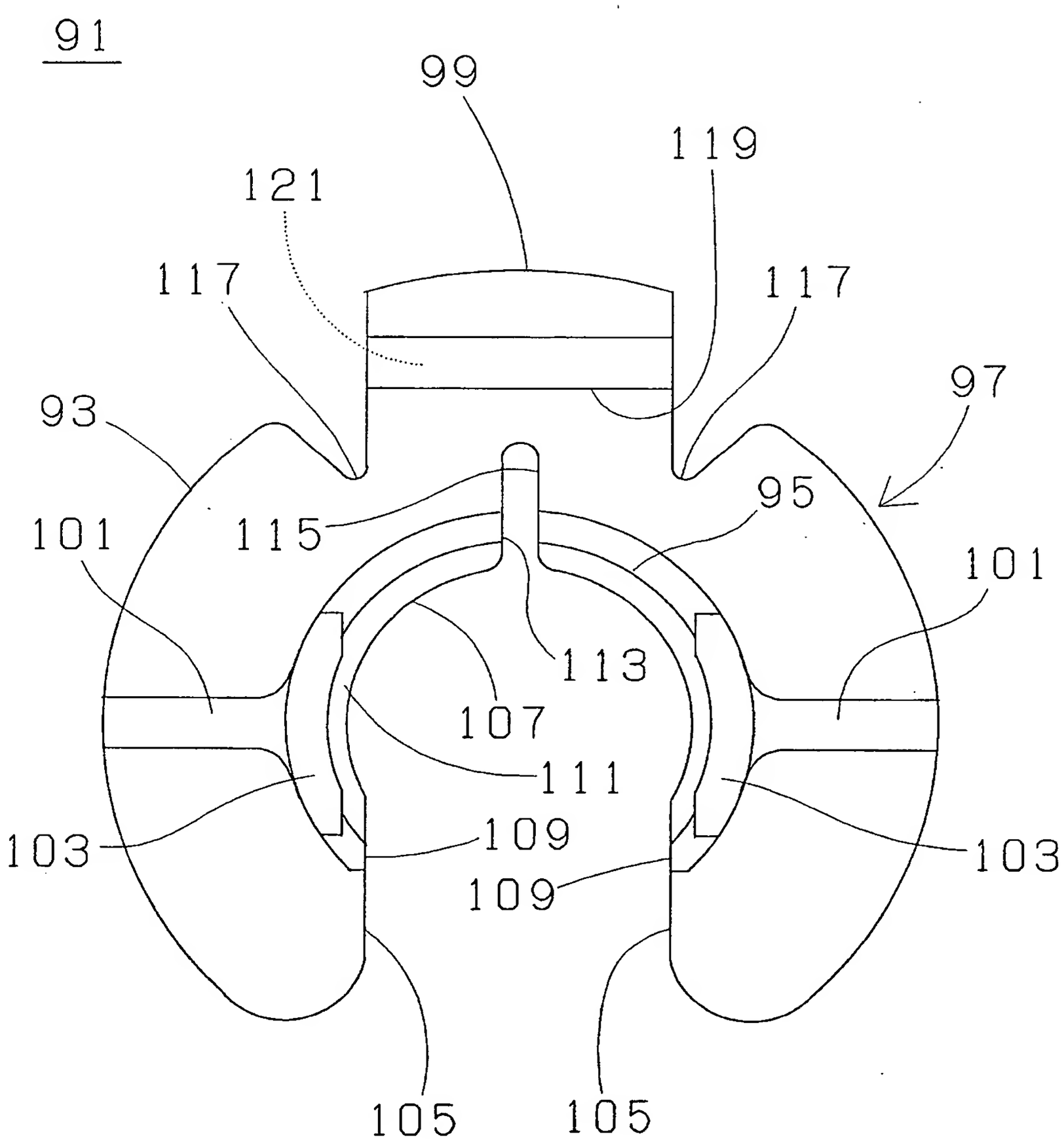
[FIG.7]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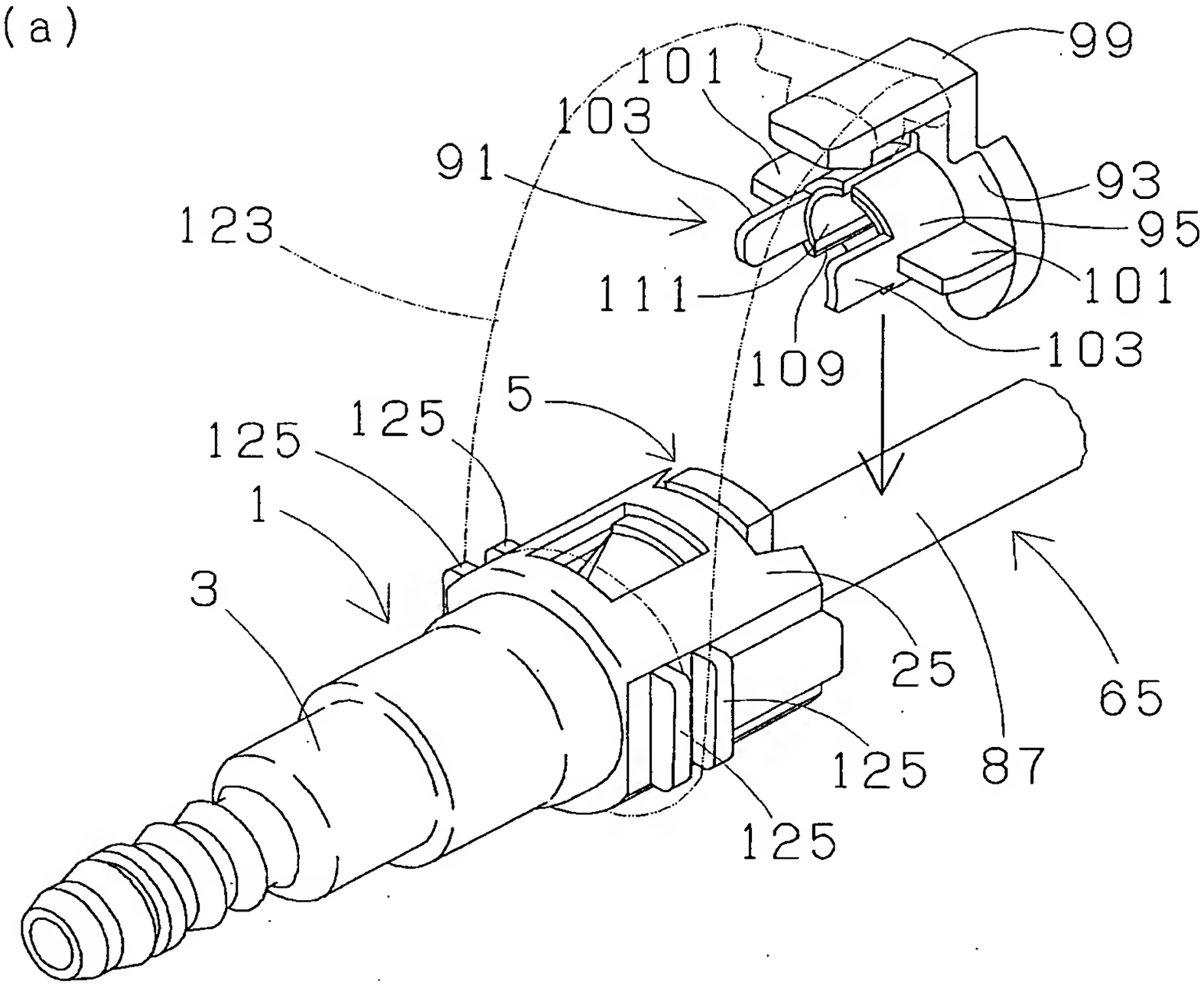
[FIG.8]

(a)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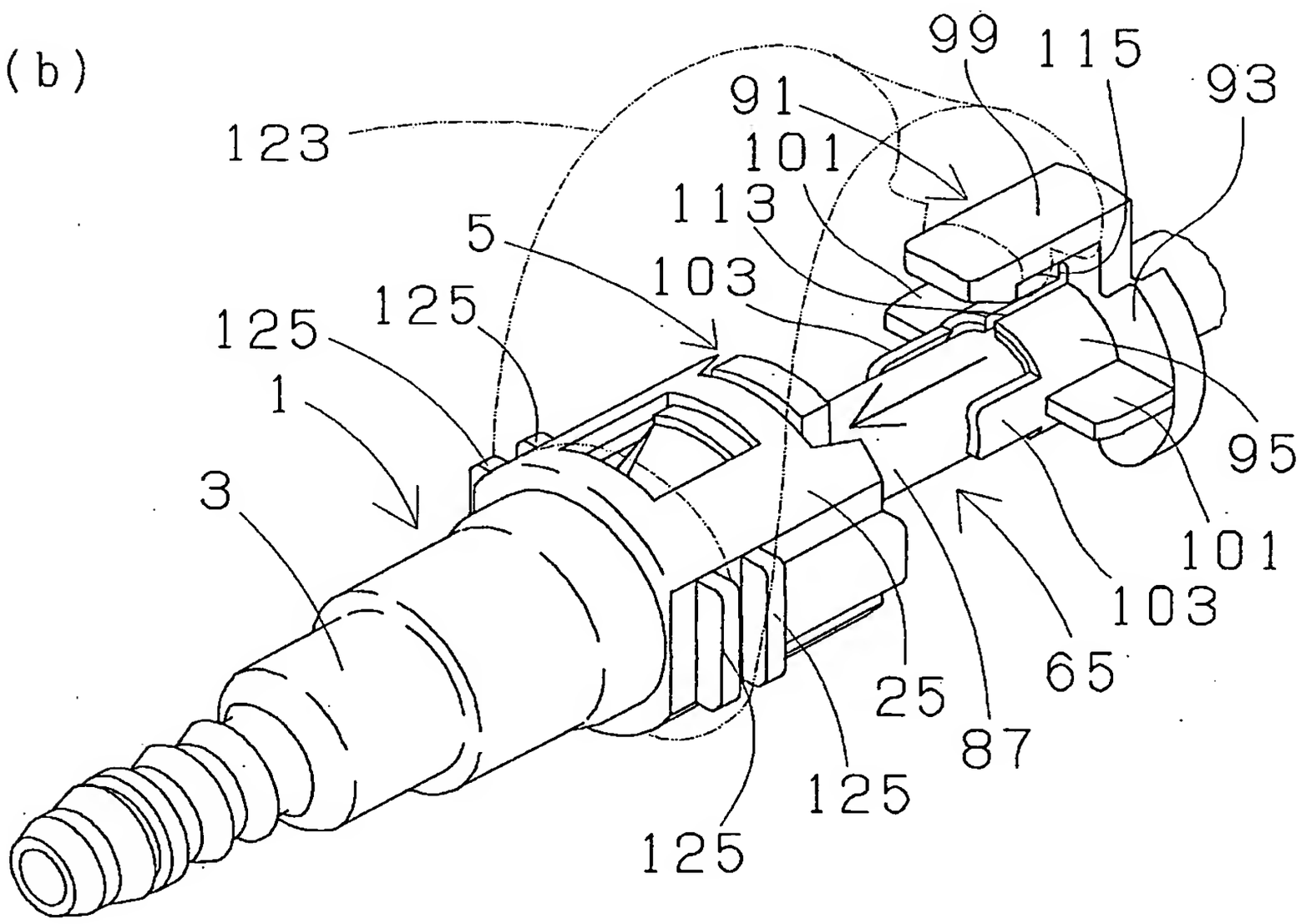
(b)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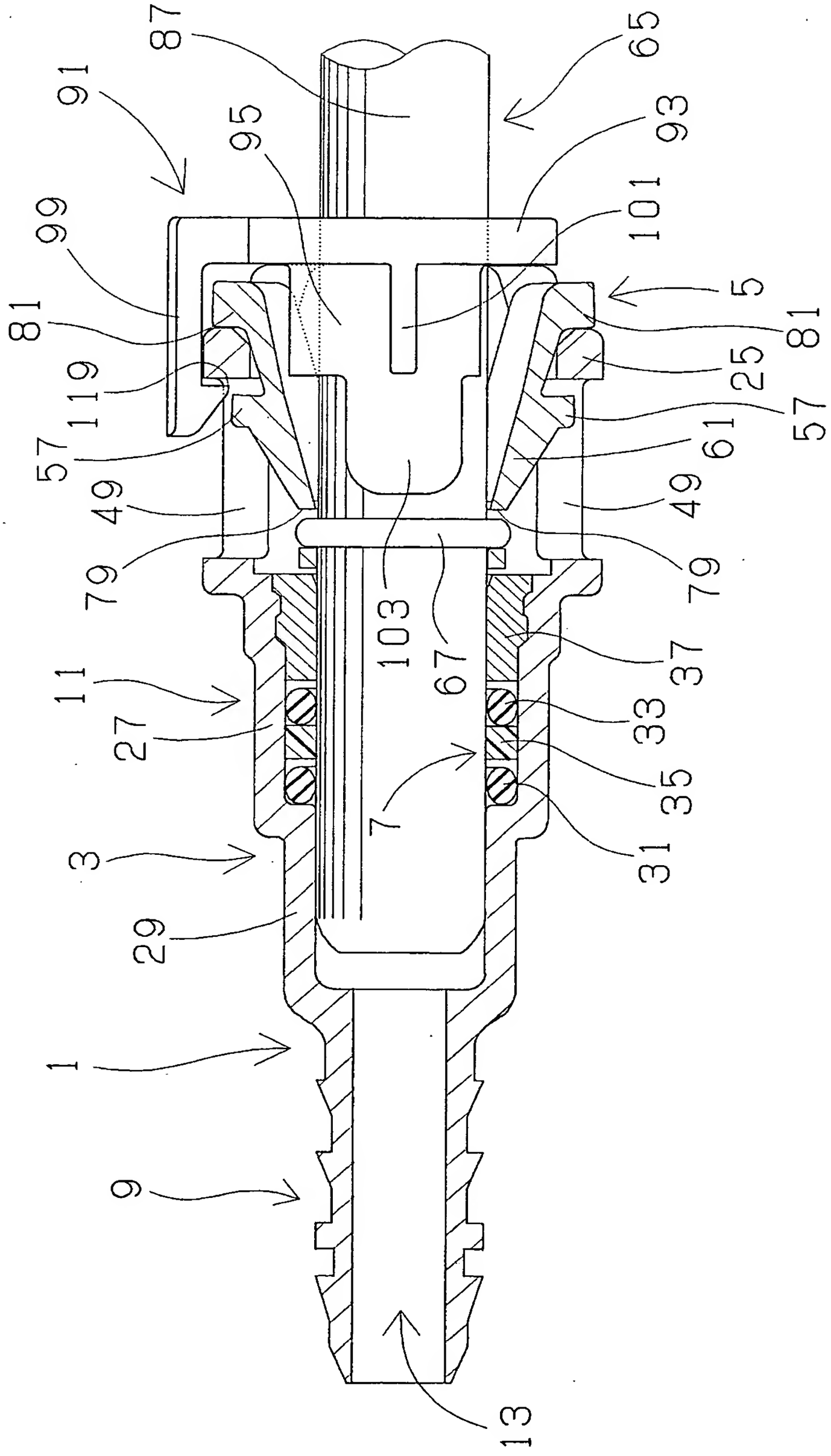
[FIG.9]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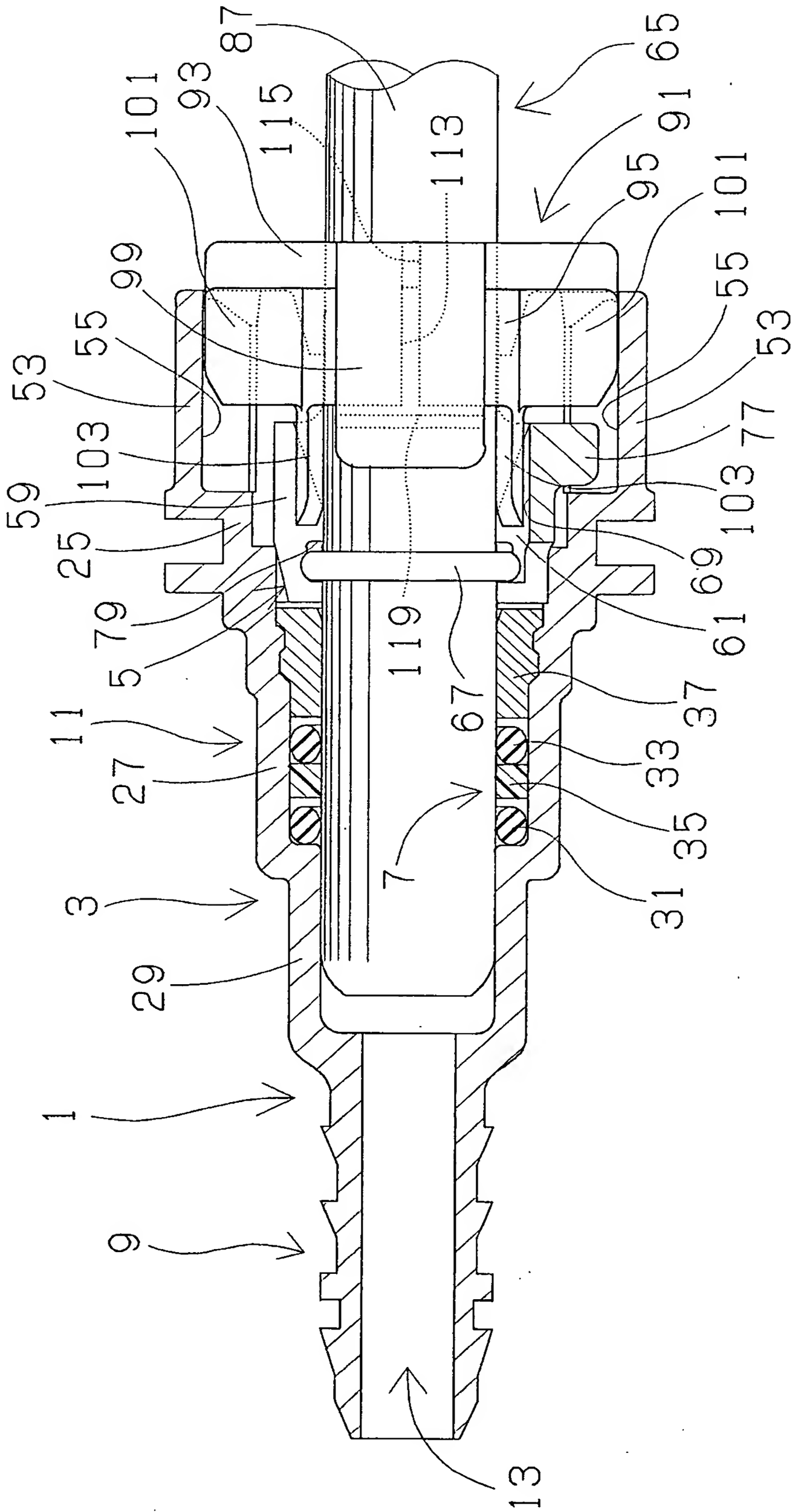
[FIG.10]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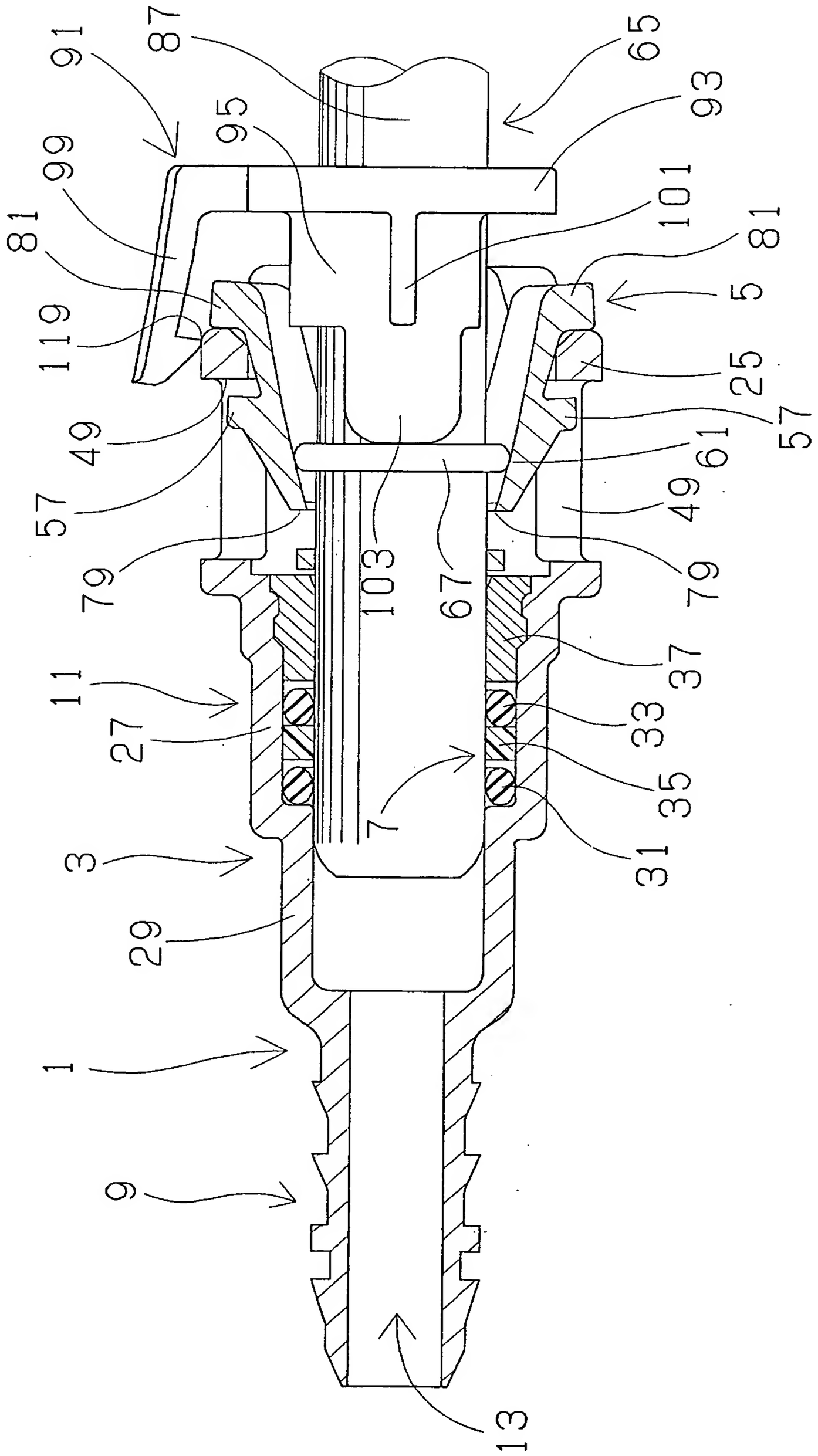
[FIG.11]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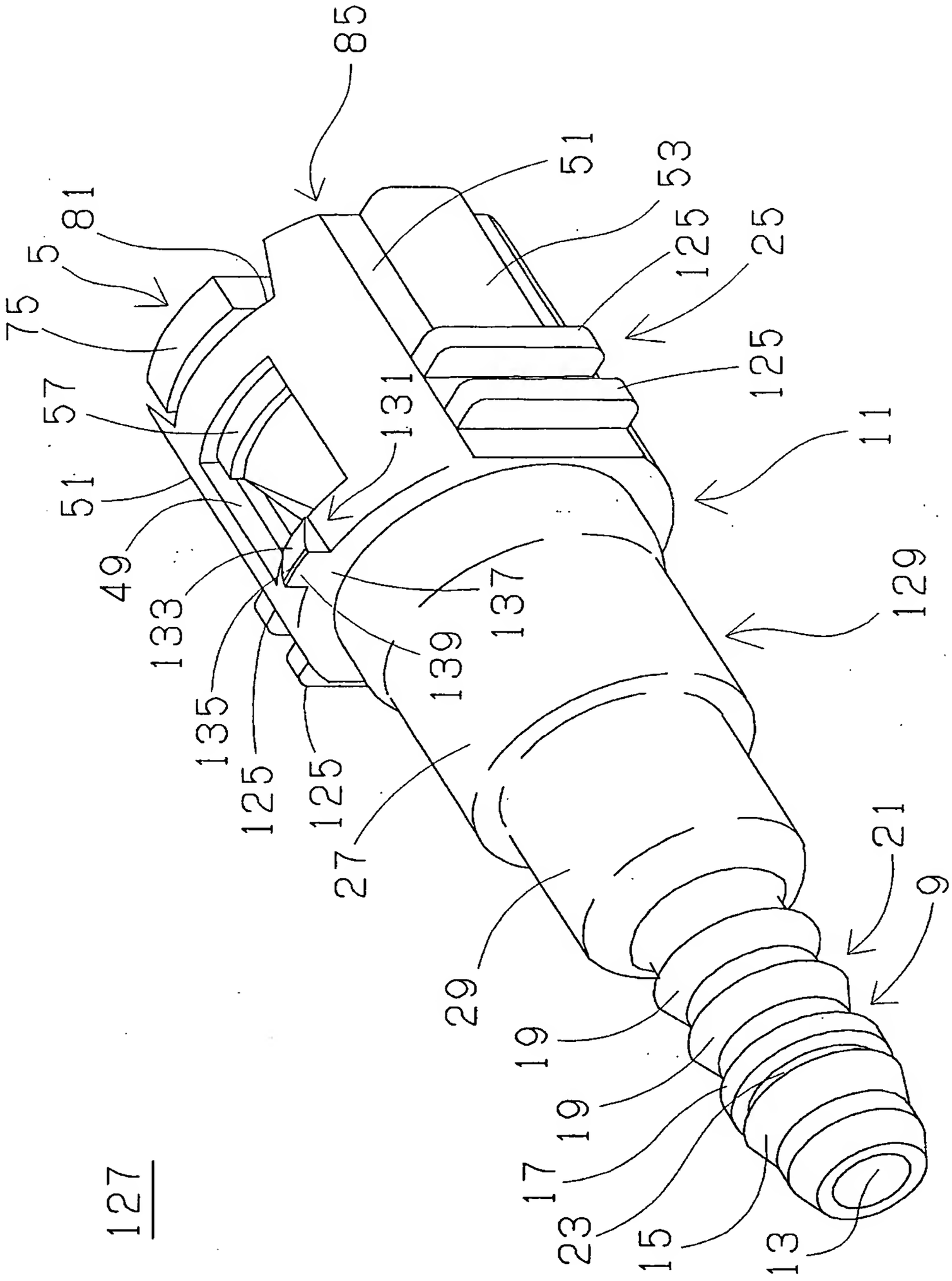
[FIG.12]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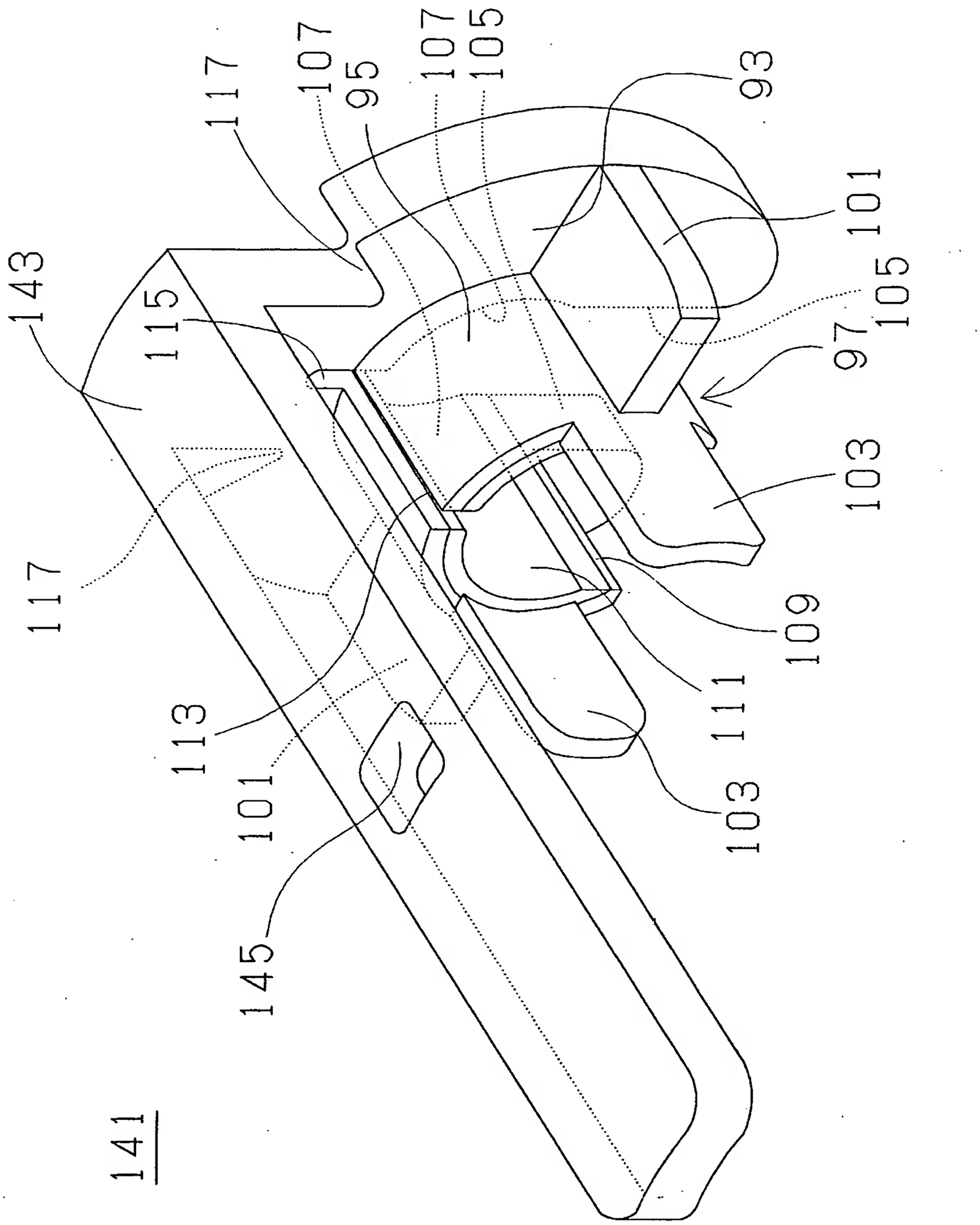
[FIG.13]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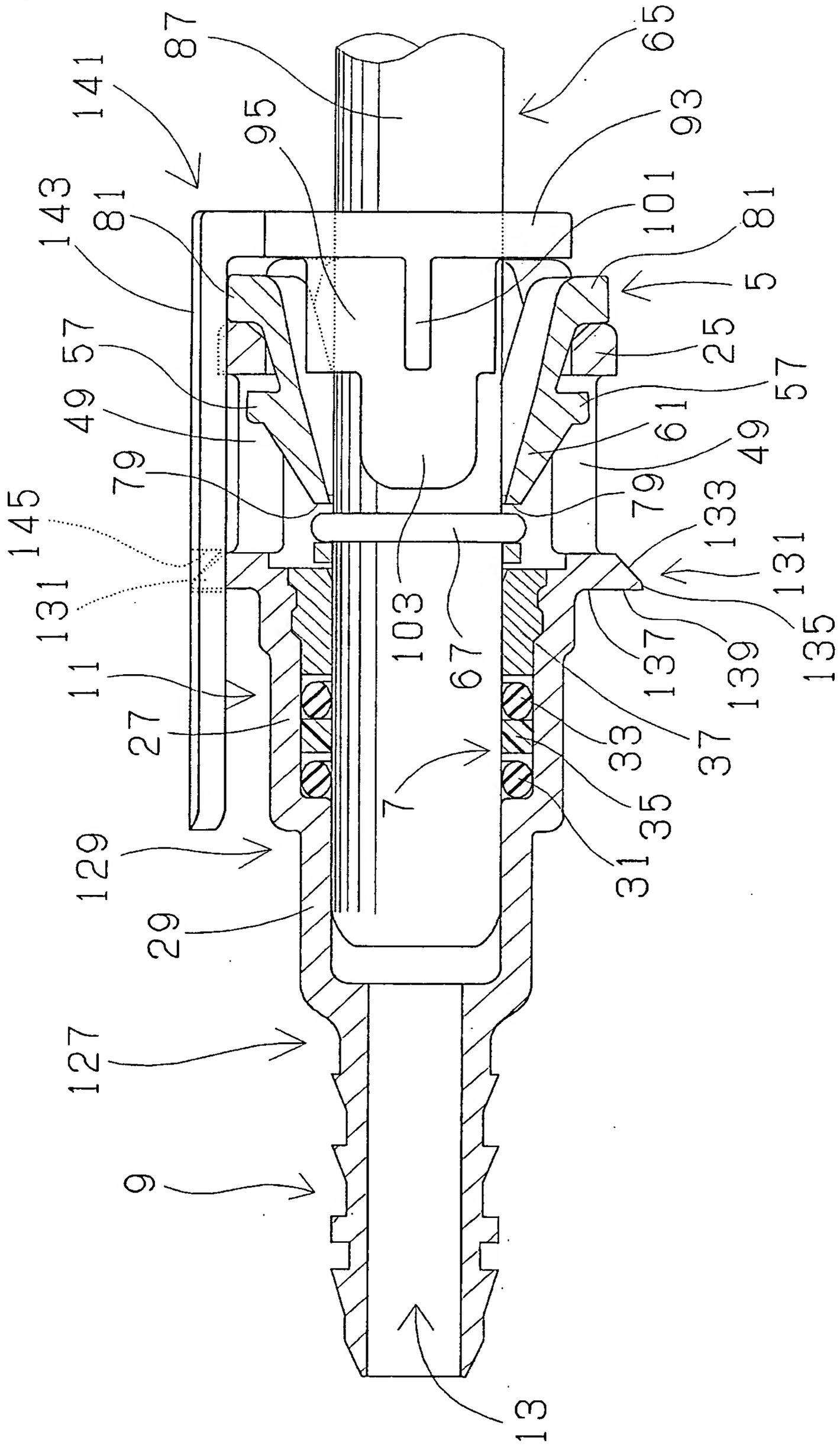
[FIG.14]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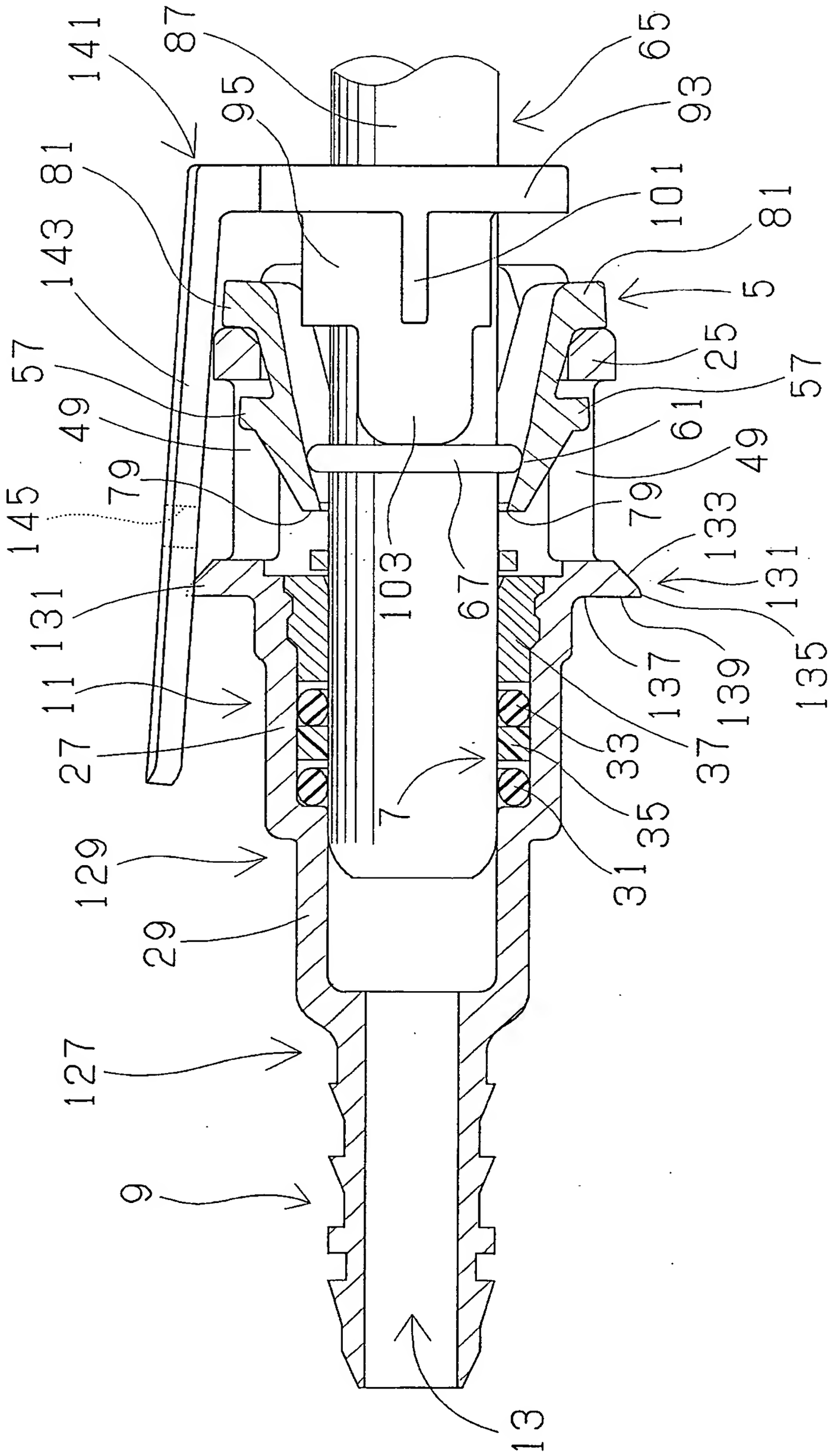
[FIG.15]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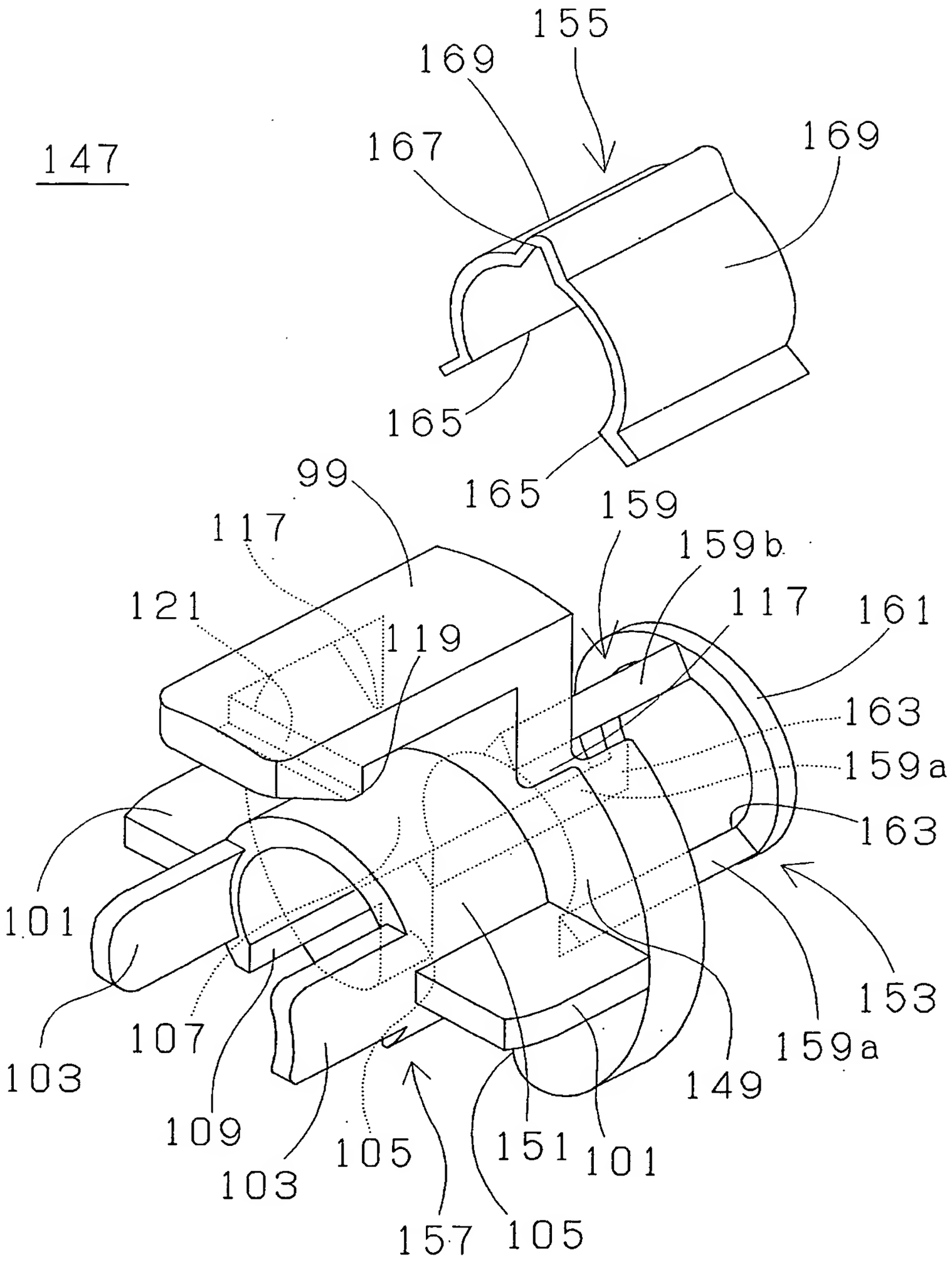
[FIG.16]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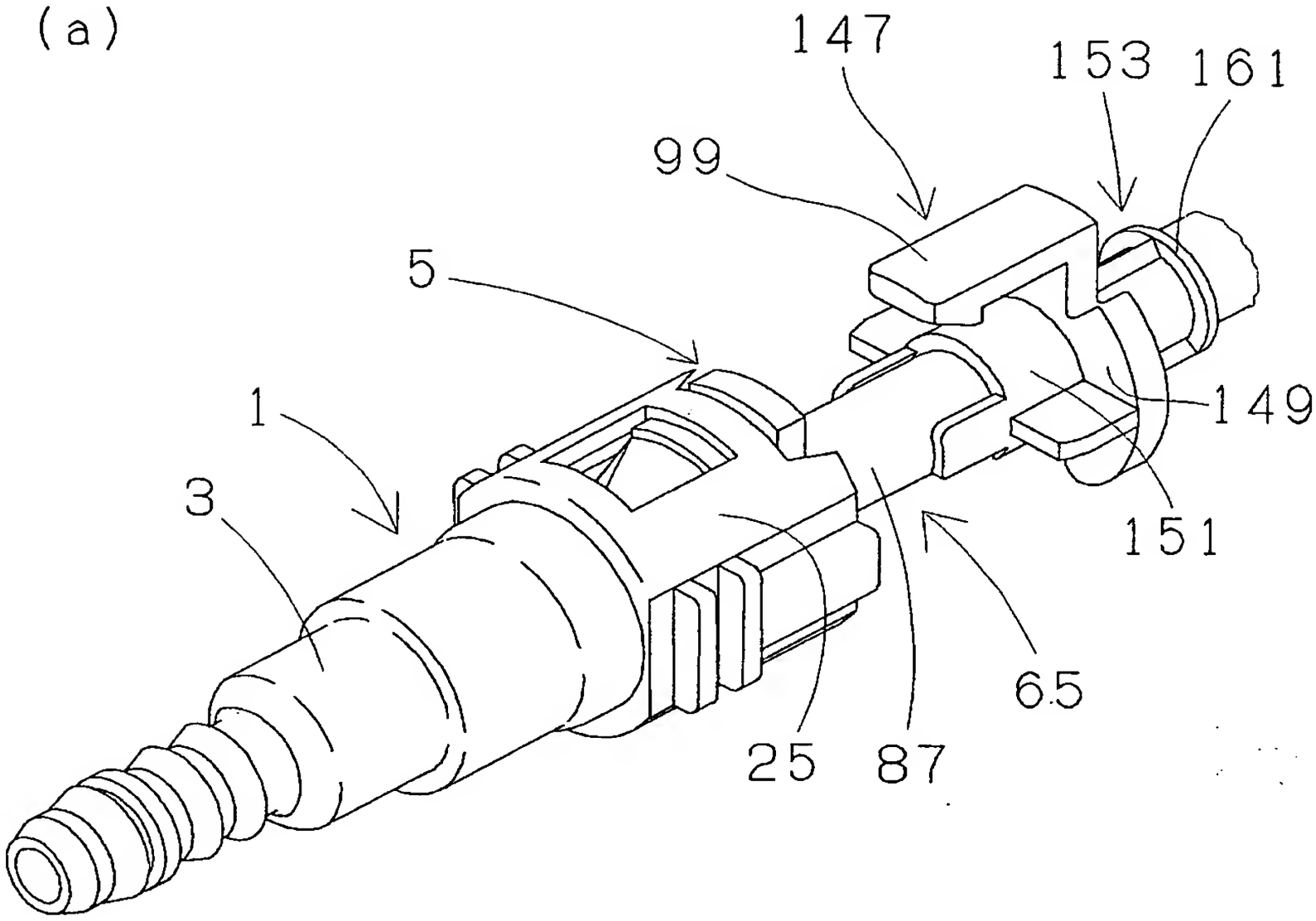
[FIG.17]

(a)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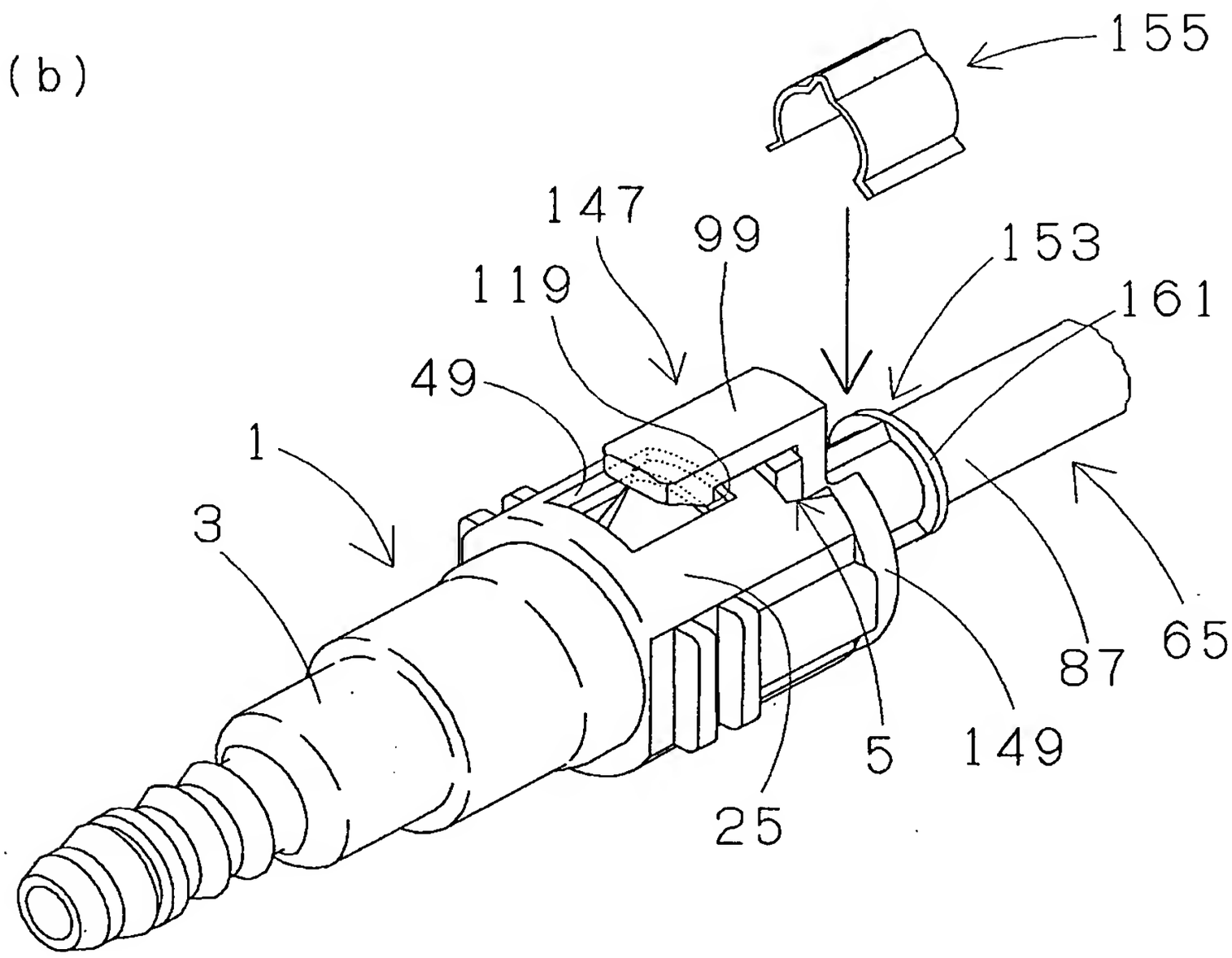
(b)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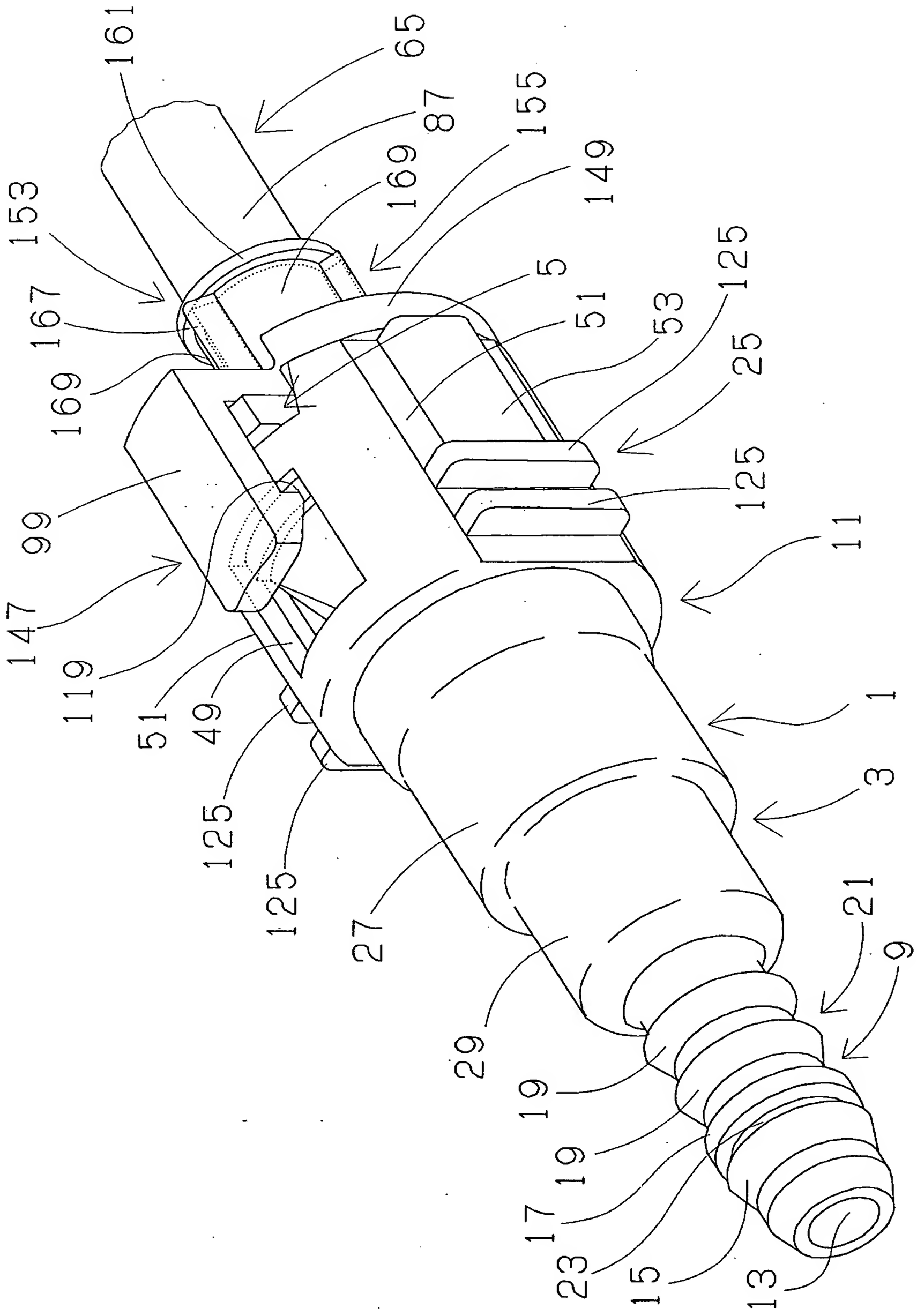
[FIG.18]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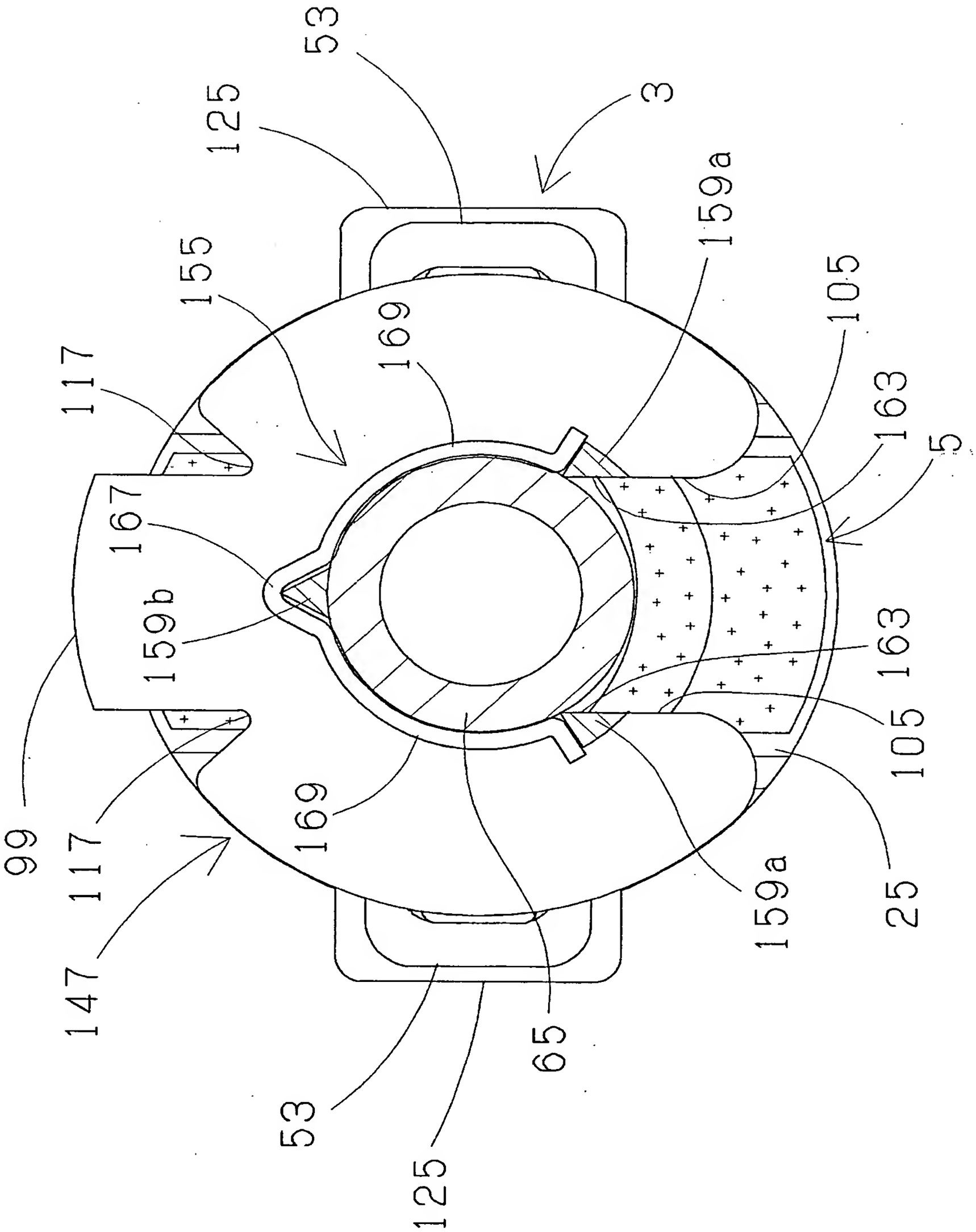
[FIG.19]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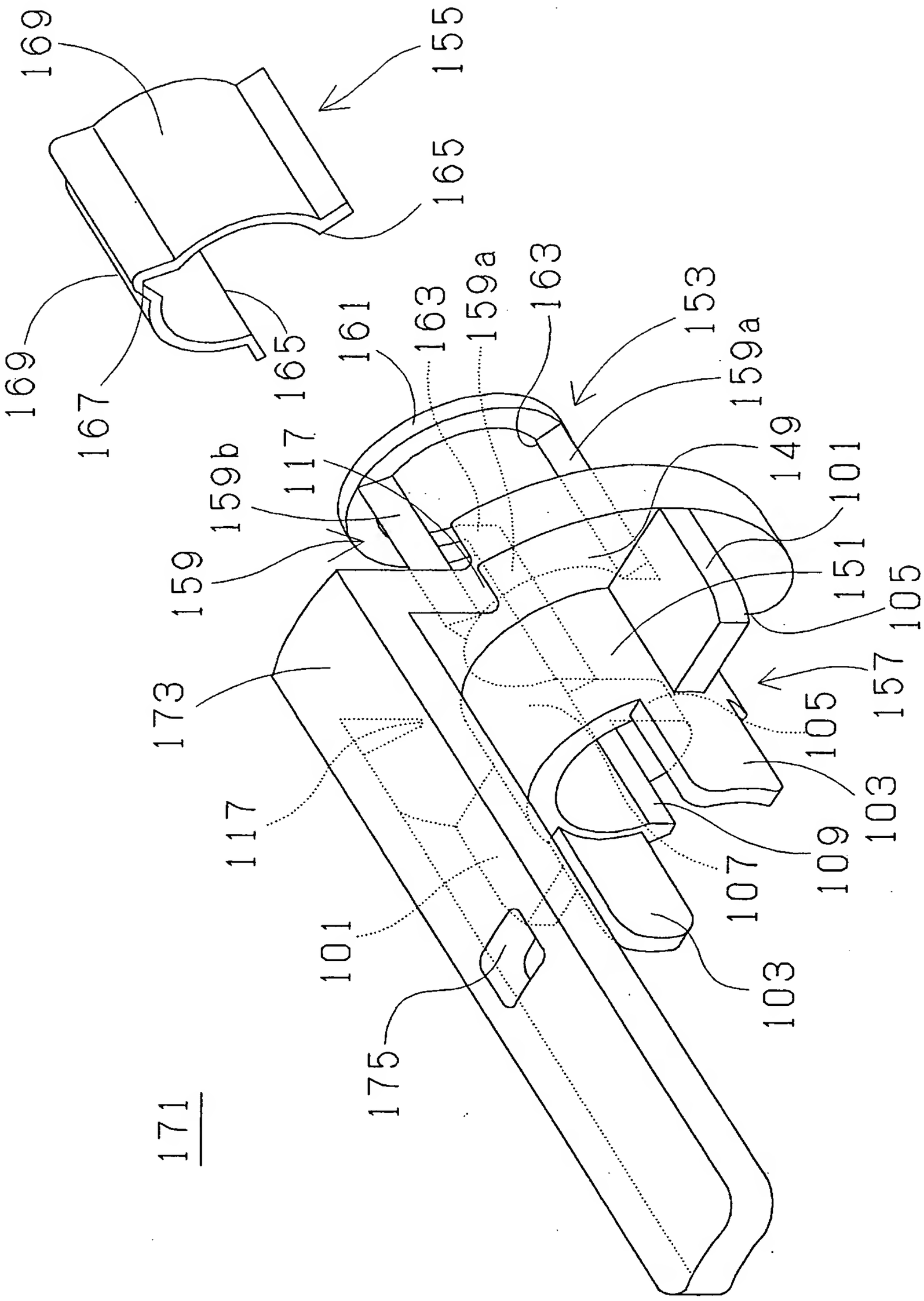
[FIG.20]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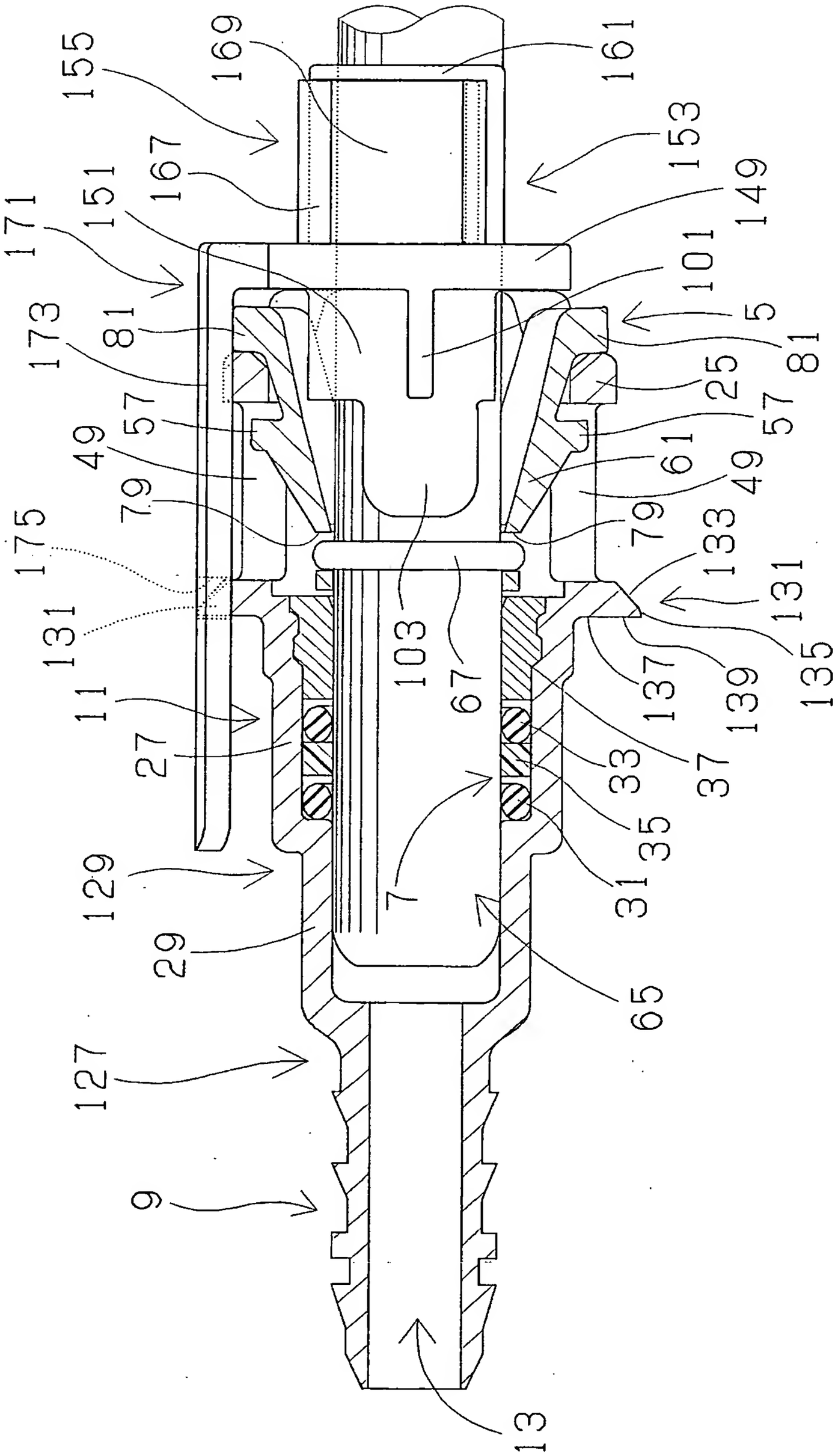
[FIG.21]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[Name of the Document] Abstract

[Abstract]

[Problem to be Solved] To provide a connector anti-rotation device which can be mounted on an assembled unit of a connector and a pipe without utilizing a bent portion of the pipe and can effectively prevent relative rotational movement of the connector with respect to the pipe.

[Means to Solve the Problem] Connector anti-rotation device 91 comprises a C-shaped abutment plate 93 having a tightening recess 107, tightening portion 95 of C-shape in cross-section projecting from the abutment plate 93 in one axial direction, and a pair of rotation preventive plates 101, 101 formed integrally on the tightening portion 95. An inserting side portion of a pipe is fitted in the tightening recess 107 and the tightening portion 95, and the tightening portion 95 is narrowed in diameter while being received in a retainer holding portion 5 so that the rotation preventive plates 101, 101 seat in rotation preventive engagement recesses 55 formed in the retainer holding portion 25.

[Representative Drawing] Fig. 6

Indicated Information/Added Information

No. of Patent Application	Patent Application No. 2002-288166
Receipt Number	50201472470
Name of Document	Patent application
Official in Charge	Senior staff, Fourth Examination Department 0093
Creation Date	October 1, 2002

<Indicated Information/Added Information>

[Date of Submission] September 30, 2002

[Name of Document] Amendment
[Address] To: Commissioner, Patent Office
[Case Identification]
[Application No.] Patent Application No. 2002-288166
[Amender]
[Identification Number] 000219602
[Name or Appellation] TOKAI RUBBER INDUSTRIES, LTD.
[Representative] Akira Fujii
[Amendment 1]
[Document to be Amended] Request
[Item to be Amended] Inventor
[Mode of Amendment] Change
[Contents of Amendment]
[Inventor]
[Domicile or Residence] c/o TOKAI RUBBER INDUSTRIES, LTD., 1, Higashi 3-chome, Komaki-shi, Aichi-ken
[Name] Akira Takayanagi
[Inventor]
[Domicile or Residence] c/o TOKAI RUBBER INDUSTRIES, LTD., 1, Higashi 3-chome, Komaki-shi, Aichi-ken
[Name] Tomoki Inoue
[Others] The present invention is made by two inventors, Akira Takayanagi and Tomoki Inoue. However, due to mishandling at filing of this patent application, only Akira Takayanagi is stated as an inventor on the Request. Therefore, the inventors are revised to two inventors, Akira Takayanagi and Tomoki Inoue by the above amendment.

Indicated Information/Added Information

No. of Patent Application	Patent Application No. 2002-288166
Receipt Number	50301565740
Name of Document	Amendment
Official in Charge	Toshinori Komazaki 8640
Creation Date	November 6, 2003

<Indicated Information/Added Information>

[Date of Submission] September 24, 2003

[Name of Document] Procedure Supplement

[Date of Submission] September 24, 2003

[Address] To: Commissioner, Patent Office

[Case Identification]

[Application No.] Patent Application No. 2002-288166

[Submitter]

[Identification Number] 000219602

[Name or Appellation] TOKAI RUBBER INDUSTRIES, LTD.

[Representative] Akira Fujii

[Name of Document Supplemented to] Amendment

[Contents of Supplement] Mutual declaration by inventors is submitted.

[List of Articles Submitted]

[Name of Article] Declaration 1

[Name of Article] Declaration

[Attached Document]

Declaration

September 18, 2003

We, Akira Takayanagi and Tomoki Inoue hereby declare that we are true inventors with regard to the following patent application.

Note

1. Application No. Patent Application No. 2002-288166
2. Title of the Invention CONNECTOR ANTI-ROTATION DEVICE AND CONNECTOR ANTI-ROTATION STRUCTURE

Inventor
Domicile (Residence) c/o TOKAI RUBBER INDUSTRIES, LTD., 1, Higashi 3-chome, Komaki-shi, Aichi-ken
Name Akira Takayanagi (seal)

Inventor
Domicile (Residence) c/o TOKAI RUBBER INDUSTRIES, LTD., 1, Higashi 3-chome, Komaki-shi, Aichi-ken
Name Tomoki Inoue (seal)

Indicated Information/Added Information

No. of Patent Application	Patent Application No. 2002-288166
Receipt Number	20301810052
Name of Document	Procedure Supplement
Official in Charge	Toshinori Komazaki 8640
Creation Date	November 6, 2003

<Indicated Information/Added Information>

[Description of Article Submitted]

[Name of Article Submitted] Declaration 1

Information on History of Applicant

Identification No. [000219602]

1. Date of Change November 15, 1999

[Reason for Change] Change of Domicile

Domicile 1, Higashi 3-chome, Komaki-shi, Aichi-ken

Name TOKAI RUBBER INDUSTRIES, LTD.